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PACIFIC DISCOVERY

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PRE-DISCOVERY

AUSTRALIA and New Zealand have so much in common with America -- especially with western America, we on the West Coast like to think -- that we naturally considered both countries at the same time in terms of "special issues." The one for New Zealand came first (July-August 1954) chiefly because we have a correspondent on the spot who talked his fellow-scientists into writing articles. The handsome reception and success of that issue, in New Zealand itself, gave us the confidence to invite contributions from men similarly occupied in scientific work in Australia. For suggestions, and for personally introducing *PD* in Commonwealth university and museum circles during his recent work down under, we are greatly indebted to Dr. R. A. Stirton of the University of California Department of Paleontology at Berkeley. To the dean of Australian geographers, whose distinction is international, Dr. Griffith Taylor, the editor is personally grateful. His lead-off part in this issue can be traced, in our own mind, to a memorable and inspiring visit with him at the University of Toronto almost exactly ten years ago -- the year before *PD* was conceived! Our acquaintance with the other contributors on paper only makes us feel sure they would be dinkum chaps to know, too, and our gratitude to them is no less warm. Unfortunately, not all papers submitted from across the Pacific could possibly be fitted into this extra-paged issue. Some are to appear later. With our thanks to all contributors in equal measure goes the assurance that postponement of any paper implies no lack of worth and interest. We find ourselves already with an assured demand for another New Zealand "special," from New Zealand itself, and hope history will repeat with the Australia venture, too. Finally, but not at all least, we wish to acknowledge the very great (but not exceptional, for Aussies are apparently just that way) courtesy and helpfulness of Geoff de Fraga, who heads the Australian News and Information Bureau in San Francisco, and his quite charming secretary, Miss Sandra Fry -- they allowed us free run of a splendid photograph file.

PD'S AUTHORS

DR. GRIFFITH TAYLOR'S career and honors may be found in *Who's Who in America*. He was Australia's first professor of geography, 1920-28; professor of geography at the University of Chicago, 1929-35; first professor of geography in Canada in 1935, retiring from his chair at the University of Toronto in 1951. He has been president, in turn of the British Geographers and of the American Geographers. A Fellow of the Royal Australian Academy of Science, Dr. Taylor now lives at Seaforth, N.S.W. . . . ¶ **Norman B. Tindale,** Anthropologist, South Australian Museum, Adelaide, S.A., has given many years to the sympathetic study of the original Australians. He was with California's R. A. Stirton on the "Digging Down Under" expedition (*PD*, March-April 1954). . . . ¶ **H. J. Frith,** Senior Research Officer, Wildlife Survey Section, Commonwealth Scientific and Industrial Research Organization (CSIRO), has spent the postwar years in ecological studies on various game bird species in Australia and on Pacific islands. Our associate editor A. Starker Leopold, hearing him lecture in the U. S. on his current megapode research, recognized the extraordinary interest in the discoveries of remarkable temperature-control techniques on the part of a bird. . . . ¶ Last summer **Dr. N. C. W. Beadle** found himself "cadred off" from the University of Sydney to head the Botany Department at the newly founded University of New England at Armidale, N.S.W. Recognized authority on the eucalypts, Dr. Beadle is also an ardent philetalist. . . . ¶ Tasmania is about as far "from Missouri" as you can get, but that is where a Fulbright Scholarship has taken one native of Kansas City, **Dr. Harold C. Reynolds,** for research on monotremes and marsupials at the Department of Zoology, University of Tasmania, Hobart. With his doctorate from the University of California, he held a professorship there and a research post in the Museum of Vertebrate Zoology at Berkeley, and was with R. A. Stirton in the Australian desert in 1953. . . . ¶ Geologist at the Queensland Museum, Brisbane, **Jack T. Woods** knows the Darling Downs of southern Queensland like his own back yard, after much field work in that famous fossil ground. . . . ¶ **George W. Bunton** manages the Academy's Morrison Planetarium. D.G.K.

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A HUNTING SCENE. Australian aboriginal bark painting from Arnham Land. (Australian Official Photograph; for full-color rendering see *Australia*, Vol. III of Unesco World Art Series).

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AUSTRALIA: CONTINENTAL COMPARISONS

THE AUSTRALIAN CONTINENT should be of special interest to Americans who are keen on the relation between environment and man. The areas of Australia and the United States are almost exactly the same;* both lands have been settled relatively lately by folk from the wet cool lands of Western Europe. Differences in latitude, topography, and climate have all been much in favor of the U.S.A. – this is already fairly clear from the difference in populations. The respective figures are 165 and 8.5 millions (though the writer believes we can support 30 or 40 millions, when Australia's resources are more fully exploited).

GRIFFITH TAYLOR

A good idea of the general environment in Australia can be gained if one imagines a lowland continent occupying the latitudes of Mexico and the southern United States. However, the important parts of Australia – important to man for settlement and agriculture – in the east and south are not unlike portions of the southern United States, especially the Carolinas in the east and California in the west. But Australia reaches in its tropic portions to latitude 10 – the same as Central America as far as Costa Rica. (The Island of Tasmania, across Bass Strait to the south, has a climate like Massachusetts in summer and like Georgia in winter.)

No contrast could be greater than that between Australia and New Zealand, our neighbor to southeastward so vividly portrayed in a recent number of *Pacific Discovery*.† The major folds of the Western Pacific, which have buckled the earth's crust and produced the scenery of New Zealand, lie far to the east of Australia. Her highest mountain is Kosciusko, a knob on the plateau-like Snowy Mountains of the southeast, and only 7,328 feet high. All along the east coast and in Tasmania are more or less isolated plateaus, rarely rising over 3,000 feet; for the rest, Australia is essentially a low plateau – about 1,200 feet above sea level – in the center and west, with a broad depression just to the west of the Eastern Highlands already noted.

Lacking the rugged topography and lively crust of adjacent New Zealand, our land has no volcanoes, earthquake areas, geysers, glaciers, or mountain lakes, such as build the chief scenic features of the island dominion. Australia is a land of wide plains, of rather open forest in the east, and of grasses and low bushes elsewhere. Some half a million square miles are covered with sand dunes, which are, however, "fixed" by grasses and shrubs – no moving sands are to be found, since nowhere is the rainfall below four inches a year.

In this large expanse of lowlands the rainfall varies a good deal in character. In the tropics the rain falls almost wholly in the three or four hot months – November to March, according to the locality – and nine months of drought is usual. In the southern coastlands the rain is largely owing to Antarctic depressions, which affect these regions chiefly in winter. The east coast is the best favored, with fairly uniform rains throughout the year; and here, in general, is the closely settled territory. Trade winds, blowing from east to west, are largely responsible for the arid character of half the continent.

There has been considerable elevation of the coastlands along the eastern and southern shores, so that very pretty scenery is common hereabouts. Fringing the northeast coast is the largest series of coral reefs in the world – collectively, the Great Barrier Reef. It extends for some 1,200 miles, and protects many small islands, where tourists are attracted by the tropical vegetation and the vivid colors of coral and fish.

Every variety of fruit is grown along these eastern shores – coconuts in the north; pawpaws and pineapples in the northern central portions; oranges and peaches between Brisbane and Sydney; apples, vines, and berry fruits in the southeast. The great wheat belt is found in the plains just west of the main divide in the east, and somewhat nearer the coast in the south. Unfortunately much of the lowest land in the interior, with fairly deep soils, is much too dry for any crops, though it is given over to vast flocks of sheep. Australia has, indeed, nearly twice as many sheep as any other nation, so that her prosperity depends very largely on the annual wool sales.

Of recent years there has been a striking shift in the economic development. In early days Australia was almost wholly concerned with agricultural and pastoral products. But there has been a tremendous increase in industrial production; and

*Australia, 2,974,581 square miles; continental U.S., 2,977,128 square miles (exclusive of inland water area and Alaska).–ED.

†Special New Zealand issue, July-August 1954 (Vol. VII, No. 4).–ED.

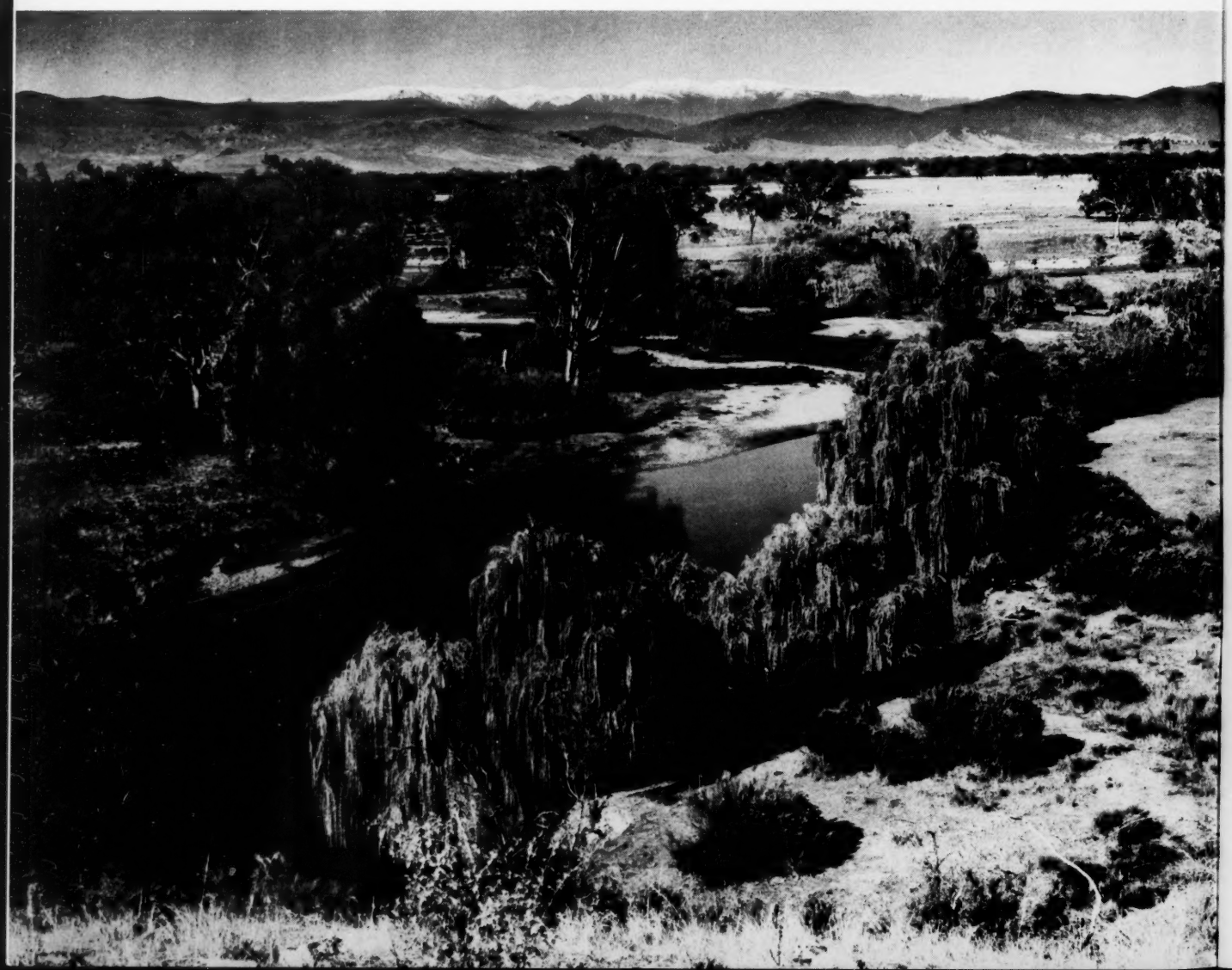
➔ Queensland's coastal plain with Townsville, port on the Coral Sea. Among the state's products shipped from here are sugar, wool, meat, sheep, cattle, dairy produce, coal, silver, lead, zinc concentrates, copper, and gold. (This and one below: W. Pedersen, Australian Official Photographs)

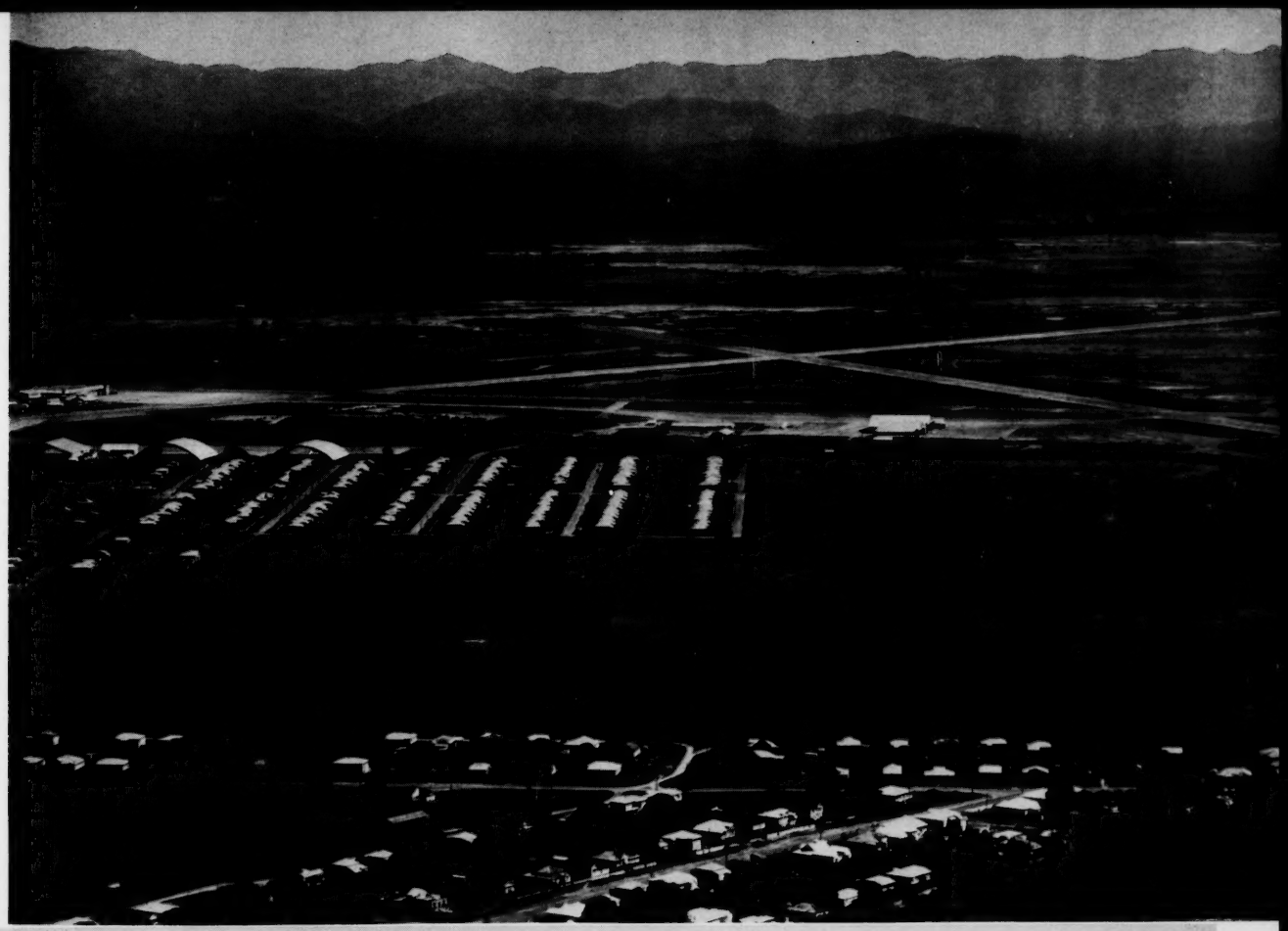
it is stated that Australian steel can be produced more cheaply than elsewhere – there are huge plants in Newcastle and Wollongong (both near Sydney). Coal mines are scattered throughout the Eastern Highlands, and near Melbourne there is an almost continuous seam of coal about 800 feet thick. The famous gold mines of Victoria are not now so important as in earlier decades; but those of Western Australia rank high among the gold producers of the world. In the far north near Darwin (Northern Territory) and Mt. Isa (Queensland) are important deposits of uranium ore. Several bores in the extreme west (near Northwest Cape) has produced flowing petroleum, and the search in the rest of the continent is widespread but with no success in the last two years.

The aboriginal population has never been numerous, and now there remain about 60,000 full-bloods, mostly living near the north coast. They represent a very primitive group of people who were driven out of southeast Asia by later-developed peoples. They are gradually finding a useful place in the pastoral areas of the Commonwealth, and their social condition is improving as a result of kindly government supervision. Very few tribes now remain without considerable contact with the European civilization.

Important numbers of immigrants from Europe have been arriving in the last decade, so that the increase from this cause is approaching that due to the natural increase of native white Australians. It was stated in 1947, however, that 99.5 per cent of the total population had been derived from British stock.

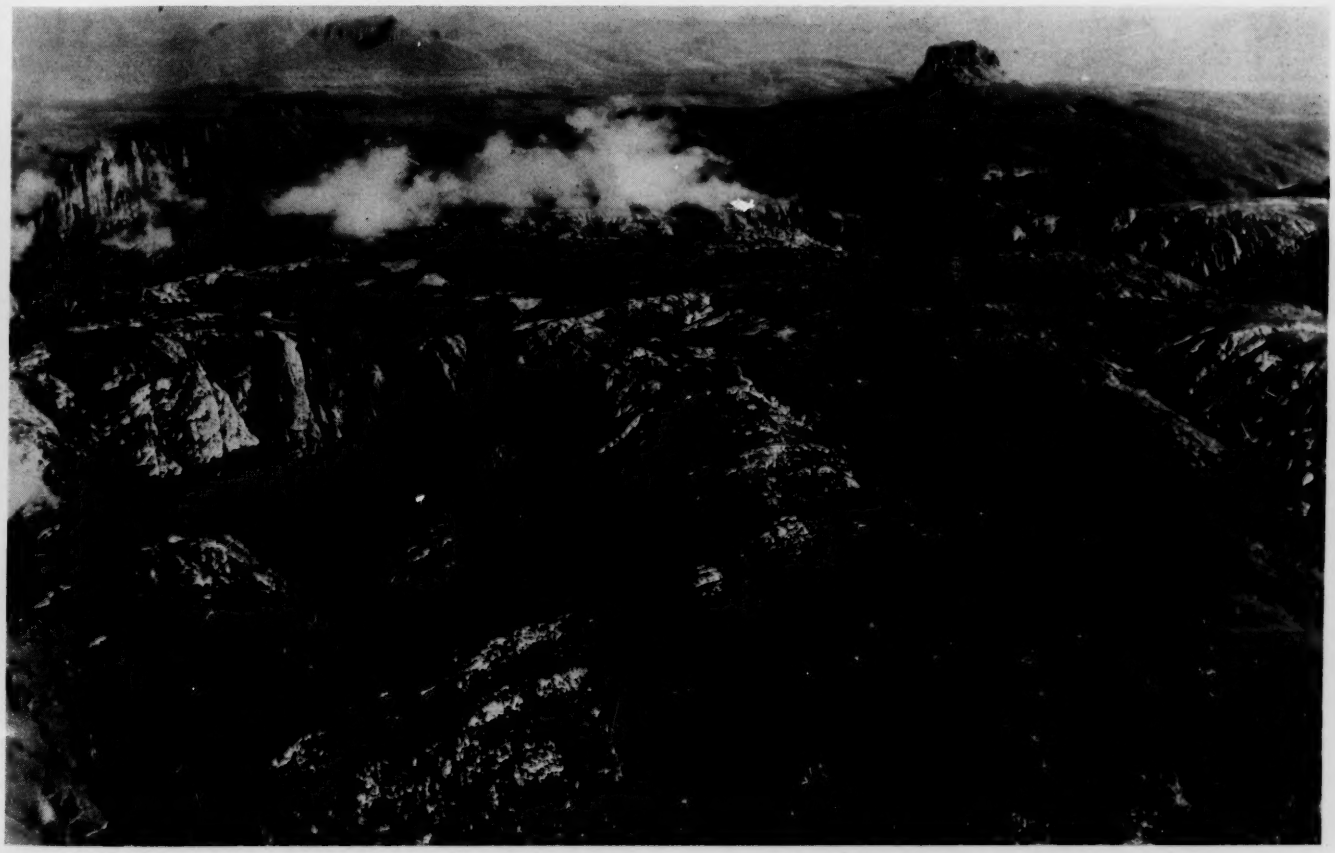
↓ Australia's largest river, the Murray, 1,500 miles long, dividing Victoria from New South Wales, flows nearly level near its source in the Snowy Mountains. The summit of the continent is Mt. Kosciusko on the horizon. (A. & H. Gibbs, courtesy Australian News & Information Bureau)





Homestead, shops, and buildings of a 6,000-square-mile cattle station on the Wickham River, Northern Territory.

← (ABOVE) Tasmania's capital, Hobart, has a magnificent harbor. (Frank Hurley, courtesy ANIB)
(BELOW) Edge of the continent in Victoria, with 300-foot cliffs and the "Twelve Apostles." (A. & H. Gibbs, courtesy ANIB)
↑ Australian Alps and Mt. Buffalo National Park, Victoria. (Australian Official Photo)

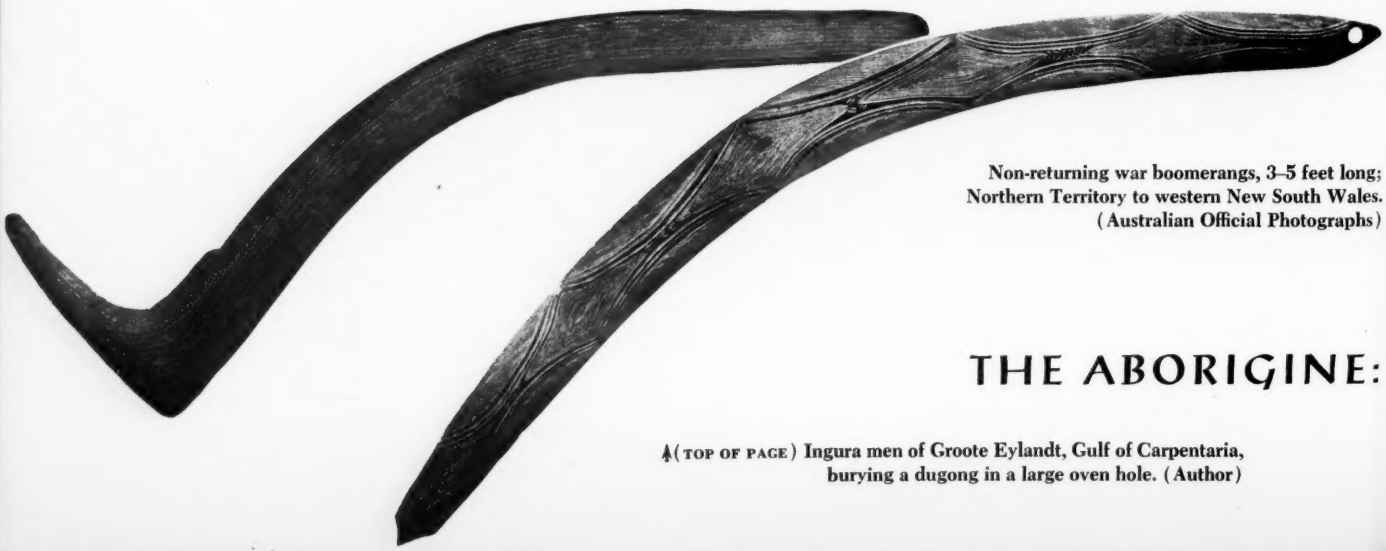


Crater Lake, Cradle Mountain, Barn Bluff, in Tasmania's center, over 5,000 feet. (Brown & Dureau, Australian Official Photo)

FIRST AUSTRALIAN

THE AUSTRALIAN ABORIGINES are the world's most primitive surviving hunting men. In some areas equipped only with the hunting implements of the Old Stone Age and in others with only a few of the tools of the early Mesolithic, they have continued to live for many centuries on the kangaroos, emus, cassowaries, wombats and wallabies which are the natural game of the Island Continent. But today anthropologists are concerned at their rapid decline and likely disappearance. They are not able to withstand the incoming Western settler, who fences the land, takes the water, and usurps the grass to feed his sheep and cattle.

Gradually but inexorably the settler has deprived the primitive hunter of every possibility of living by means of any of his age-old techniques. After his half-hearted attempts to survive by killing cattle, etc., the only alternative compels the hunter to become a worker on one of the sheep or cattle ranges which have spread out into all but the remotest dry desert areas of the Continent. Coming into contact with civilized life, but unprepared to practice the basic hygiene which alone makes it possible for men to live continuously in one place, these primitive hunters succumb to the white man's minor diseases, to his coughs, colds,



Non-returning war boomerangs, 3–5 feet long; Northern Territory to western New South Wales. (Australian Official Photographs)

(TOP OF PAGE) Ingura men of Groote Eylandt, Gulf of Carpentaria, burying a dugong in a large oven hole. (Author)

measles as well as to the even more devastating effects of tuberculosis, gonorrhea, and in the north to a form of leprosy. Where thousands have been, only hundreds remain. A few folk, isolated in the remoter parts of the Great Western Desert, have for a half century been preserved from this fate, but with the advent of the automobile and, lately since World War II, the use of "land rovers" and "jeeps" there have been deep inroads into these desert fastnesses. The opening up of new "stations" has lured even the most isolated of these folk into civilization. Can we blame the stone age hunter for wishing to sample the specious attractions of a diet of tea, flour, sugar, tobacco, and the undoubted excitements of a more civilized existence?

So it would seem that the days of the primitive hunter are numbered. From Sydney in the east to Perth in the west, in a belt 200 miles wide along the coast, fewer than a dozen of the original inhabitants remain, and truly unspoiled hunting tribes are limited to a few like the Mangawara and Pintubi of the eastern interior of Western Australia and to a few independent family groups in other remote areas. Most other aborigines are now settled on Government controlled stations, or are working as sheep and cattle hands on ranches, are engaged in mining and timber cutting or, as in Queensland, are segregated into supervised areas and Reserves.

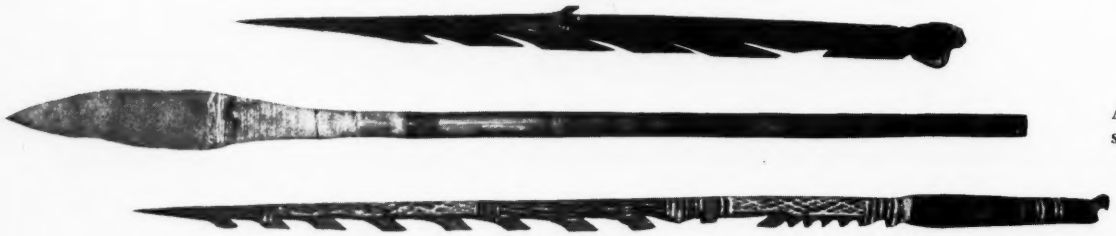
It is estimated that while the original population may have numbered about 300,000 persons divided into some 680 separate tribal units, today there may be fewer than 20,000 survivors plus a large and rapidly increasing number of hybrid *aboriginal* × *white* people. Many of the fullbloods are aged and childless. With the disappearance of the last full-blooded Australian blackfellow in the next few decades his place may well be taken by fully 300,000 people of hybrid origin in whom Western blood will come to predominate.

The study of the surviving aborigines has many purposes and it is urgent that it be continued until they are no longer with us. They have much to offer. From observations on their methods of using paleolithic stone tools alone we can learn a great deal. Their ways of hunting, their totemic beliefs, and their religious and magical ceremonies, all can help us in the understanding of the whys and wherefores of the lives of our own paleolithic ancestors and thus can reveal to us the modes of life and perhaps the parallels of the very thoughts of our own remote ancestors. But Australia is still a frontier country, researchers are few, and many tribes are vanishing without more than a vague chronicle or record being made of their ways of life. For example the Lardil, the aborigines of Bentinck Island in the Gulf of Carpentaria, were the only hunting tribe without any access to stone. Their implements were, of necessity, all made of pieces of *Melo* shells. For lack of stone hammers to use in their trimming they bit these into shape with their teeth. Within the past three years these people have been removed from their island home and today are living on a supervised station where, undoubtedly, they will decline in numbers and

An Arunta tribesman, Central Australia, shows how his forebears used the war boomerang. (J. Fitzpatrick, Australian Official Photograph)

Ngalia hunter stalking kangaroo with spear held in a spearthrower, Cockatoo Creek, Central Australia. (Author)

came to Australia from Asia, and there is some evidence that he entered the continent before the end of the "Würm phase" of the Great Ice Age, finding a land occupied solely by giant marsupials, like *Diprotodon** (size of a rhinoceros) and *Nototherium,* by giant birds (*Genyornis*) up to nine feet tall, and by many other species of animals now extinct. Relics, in the form of implements made from pebbles and coarse blocks of stone, have been found in circumstances indicating a late Pleistocene date for their origin. These implements are assigned to the Kartan Culture, so named for a site on Kangaroo Island in South Australia. Some thousands of years later must have come men using



Australian spearheads.

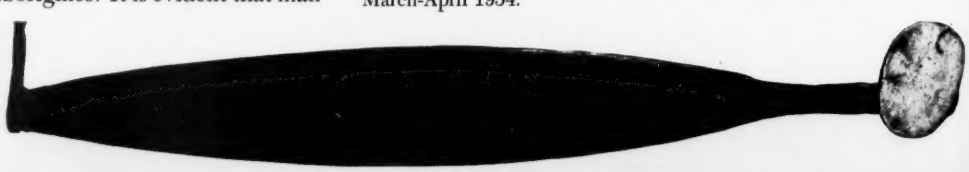
their former ways of life and traditions will be lost. So also the Mangala natives of the interior of the Desert Basin of North Western Australia have all succumbed to the lure of ranch life. Their ancient totemic sites are now unvisited, their desert lore is being forgotten, and lost is their intimate knowledge of a thousand small sources of water supply in a waterless country where once they were able to live. They could never go back and live in their desert. Meanwhile they and their children wither away into extinction.

Anthropologists are needed to study these people, to record their lives, beliefs, and knowledge before the data are lost to the world. But there are difficulties of many sorts to overcome. Research is hard, because of the remoteness of the areas, the language difficulties, and, not least, the frequent unwillingness of the white owners of the ranch country to allow access by anthropologists to their native people, on whose devoted labor they now have come to depend for the maintenance of their ranches. Despite such difficulties research must go on, and quickly, for but a short decade remains for detailed work. In many areas it is already too late!

Who were the aborigines? It is evident that man smaller flaked implements. These later relics are recognized as of the Tartangan Culture. Tartangan implements were associated with food animals of several species which are now extinct. A Carbon 14 date has been obtained for a Tartangan camp on the River Murray at Tartanga. This site was in occupation 6,020±180 years before the present time. The date indicates that they must have lived in southern Australia during much of the earlier half of Recent Time. There was a very distinct change of culture some 5,000 years ago and by 4,250±180 B.P., according to another Carbon 14 date, a stone-spear-head using people, called the Pirrian folk, had replaced the Tartangan hunters. Some of the projectile points of the Pirrian people, although made by entirely different techniques, were as fine as any of those made by the Yuma and Folsom peoples of North America.

From the present existence and distribution of three ethnic strains in the Australian population, it is deduced by Dr. J. B. Birdsell of the University of California (Los Angeles) that the earliest inhabitants of whom we have tangible evidence

*See "Digging Down Under" by R. A. Stirton. *PD,* March-April 1954.



A Queensland spearthrower.

were Negritos. This relatively dwarf-sized human type composed the now extinct Tasmanian population, as well as surviving in mixed form, hybridized with Australoids, in the rain-forested areas of coastal Queensland. The present writer found them to be living near Lake Barrine some twenty years ago, and as a result these people have been called "Barrineans." They have deeply curly, and often crisp hair and were no taller than about five feet.

A second wave of people seems to have appeared in Australia at about the end of the Ice Age. They were much taller, more robustly built, with heavy, hairy bodies, light brown skins and low-waved hair. They have been named the Murrayians. They spread widely over the Australian continent, gradually absorbing or eliminating the original Negrito inhabitants from most areas of the mainland. In their mythology the modern representatives preserve traditions of their encounters with a dwarf people, whom they called, in one area, the *thakuni*. The Murrayians are the so-called "blackfellows" of the southern half of Australia, although their skin color was far from black, in fact often a light shade of brown.

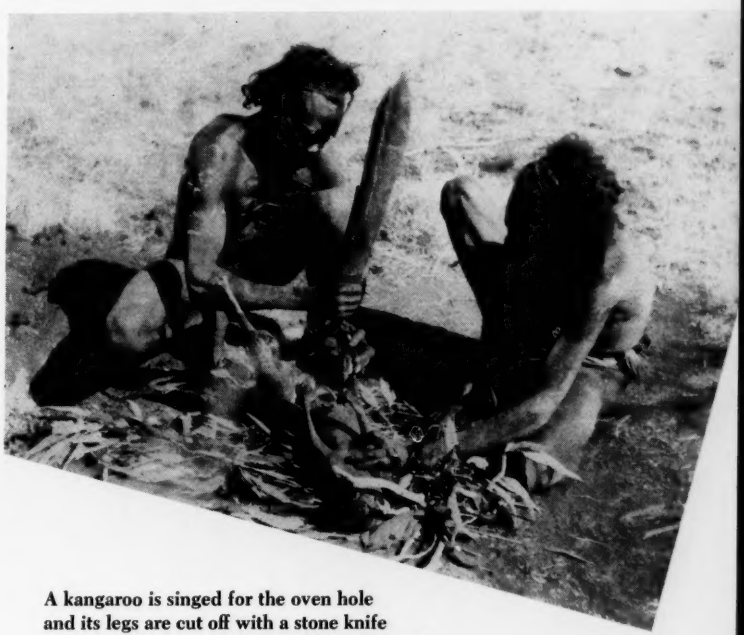
In the northern parts of Australia, radiating out from the Gulf of Carpentaria there came, perhaps at a later date, a third type of Australian, the so-called Carpentarian folk, characterized by relatively slender bodies, spindly legs, a very dark skin, low-waved hair, and very scant evidence of body hair. When first met by men of the Western World they were spreading down into Central Australia.

The Negritos have vanished save in one area in Northern Queensland. The Southern Australoids will become extinct in another dozen years or so and only the Carpentarian folk of the North seem partially to be maintaining their population.

How did they live? Hunting people spend long hours of each day in the quest for food. Their labor is divided. Men search for large game – kangaroos, emus, and the like – walking large distances, following fresh spoors of dingo, wallaby, rat and mouse until they make one or more kills. Endlessly their feet meander over their hunting territory, restless eyes reading the tracks in the sand and ever scanning the distant scene for signs of game. Women delve in the ground with digging sticks and with wooden scoops, searching for burrowing animals, for lizards, honey-ants and a wide

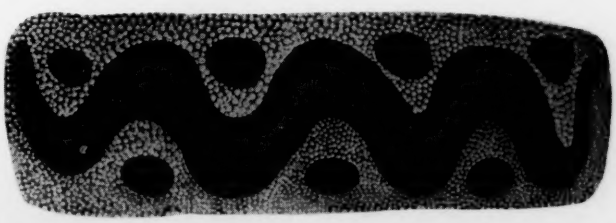
A *tjuringa* — these are sacred stones or pieces of wood belonging to members of certain Central Australian tribes. Totemic, they represent the spirit or essence of the owner. They are kept in sacred places. (Courtesy ANIB)

array of bulbs, corms, and roots which provide the vegetable part of native diet. Children accompany their mothers and early in life learn to delve and dig for themselves. The food quest uses from four to eight hours of each day with no guarantee of a full belly to follow, and seldom any reserve against a rainy day. The one "big" meal of the day is taken early or late in the afternoon when weary return-



A kangaroo is singed for the oven hole and its legs are cut off with a stone knife on the end of a spearthrower. The same tool is used to cut up the cooked kangaroo. Cockatoo Creek. (Author)

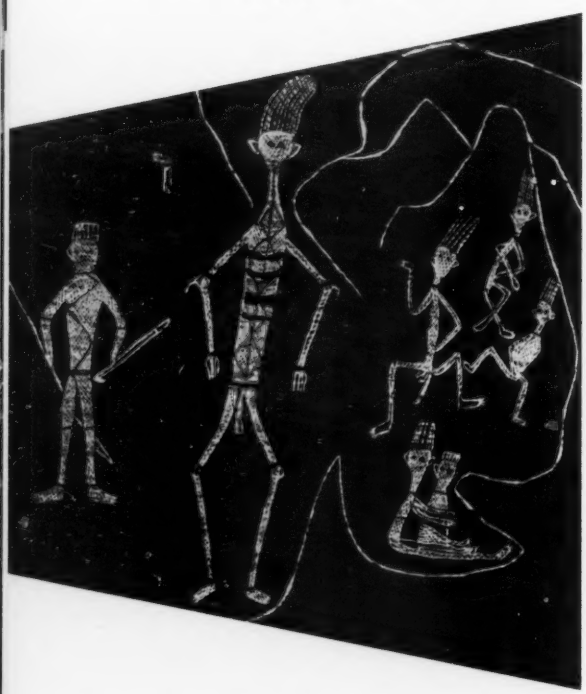
(UPPER) A characteristic totem design painted on a bark shield. (From *Australian Decorative Art* by Frederick McCarthy, Courtesy ANIB) (LOWER) Carved wooden shield, southeast Australia. (Courtesy ANIB)



Ngalia tribesmen dancing in the Kangaroo Ceremony, Cockatoo Creek, Central Australia, in 1931. (Author)

ing hunter and hard-working wife or wives pool their takings to feed the family.

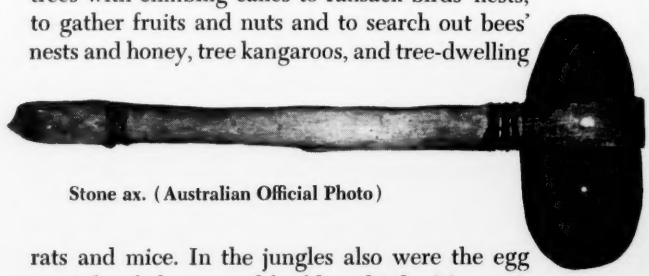
The changing seasons bring varied diets, occasional plenty, and periodic drought and semi-starvation. In the Desert Interior scattered rains fall only in summer (November to March). When rain comes the whole country for a few weeks may be a garden, with pools and claypans full of water everywhere so that, as one aboriginal song tells us, "Rain-time is the good time." This is the time when so many water pools exist that "anywhere is my camp" and it is possible to visit and exploit harvests of food which have built up in the most inaccessible parts of the hunting territory. With the cold of winter (June to August) often comes frost and bitter winds. In this weather they sleep, naked in the open air, curled around small fires, with only a low wall of bushes to form a windbreak. Food becomes harder to find, but kangaroos begin to frequent the fast diminishing water pools and fall to their spears. After July wild dingo pups are fattening in the lairs made by the female dingos. They provide a beloved source of food. With the



early months of summer comes increasing drought, shrunken water supplies, and the necessity of retreating to the most permanent pools where, because of many years of exploitation, vegetable foods often have been depleted. This is the period of testing and of semi-starvation. The most skilled hunter, with an intimate knowledge of his environment, brings his family safely through crisis until rains come again. This is the time when magical ceremonies and increase rites are performed, in the belief that thereby the totemic animals and plants will be compelled to multiply and the giant rainbow snake will fetch rain to them from out of the winds of the North West Monsoon.

During and after the summer rains, when vegetable food is for a brief while abundant, is the time for many ceremonies which brighten their lives. It is the time for dancing, and for meetings of peoples. During these great social events men may, for weeks at a time, engage in the elaborate rites which admit young men to manhood. Meanwhile their women folk toil long hours to bring them the vegetable food which enables them to have such leisure from the ordinary hunting chores of their dog days. Thus do they utilize rare leisure which comes with an assured food supply.

In the rain forests of eastern Queensland the more primitive Negrito folk, finding refuge from the hunting Australoids of the open forests and grasslands, continued until modern times to exploit the jungles for their food, climbing the tallest trees with climbing canes to ransack birds' nests, to gather fruits and nuts and to search out bees' nests and honey, tree kangaroos, and tree-dwelling



Stone ax. (Australian Official Photo)

rats and mice. In the jungles also were the egg mounds of the mound-building birds. Men poisoned rock pools and streams for fish, and their women gathered many kinds of roots and seeds of the forest, including the much sought after flour yielded by that primitive palm-like tree, the burrawang (*Macrozamia*), whose fruits are regarded by the aborigines as so poisonous that long treatment in running water and special roastings are necessary to eliminate the noxious principle.

Despite their primitive ways of living, the social structure of the culture of the aborigines is not simple, and their traditions and mythology are deep and rich. Much has been learned about their kinship systems and this has been of great help in the understanding of the social organizational phe-

Aboriginal art and ceremony relate to religious and mythological beliefs. (ABOVE LEFT) Bark drawing by an Arnhem Land artist illustrating the adventures of the mythical Mimi spirits who are said to live in rocky caves. (Jack Brand, Aust. Official Photo) (RIGHT) Chanting before a circumcision ceremony, with music by the *didjeridoo*, a long stick hollowed out by termites. (C. P. Mountford, Australian Official Photo)

nomena of other peoples. All members of a tribe fall into a single kin system so that whether one be a male or a female one applies one of a limited number of relationship terms to each and every person within the tribe. Father and his brother are equally called father, mother and her sisters are mother. So if one is a male a whole group of women fall into a kin whom one calls "wife" and one or more of these will become wife in more than name. In addition to such kinship terms there usually is a division of all the people of a tribe into two-, four- or eight-named classes or divisions; running parallel with this are systems of totems, named after animals, plants, insects, or even after mythical beings. All these devices serve purposes of social control, determining marriages, responsibilities and leadership in the performance of magical ceremonies, and helping to create and maintain the strength of fraternal and other generational groups within the tribe.

The material culture of these people is of great interest. Only in Australia has it been possible for anthropologists to study at first hand the stone-tool-shaping methods practiced by Old Stone Age man. The present writer has himself observed in use many of the most primitive as well as some of the most advanced forms of such implements, and has even seen examples made, hafted, resharpened, in use time and again, and finally cast away when worn out and useless. In setting handles for stone implements much use is made of resins and the gum of trees. It may be a surprise to learn that many hafted stone tools are only slightly less efficient than some tools of metal such as are in use today among people of our own culture. Especially we may cite a fine steel chisel which has been misused by Mrs. Smith to open a can of beans, or keenly sharpened steel axe used by Mrs. Brown in chopping cordwood on a gravel path. Stone Age man approaches his work no less vigorously than we would do it. Highly skilled work is done and the finished weapon or object is completed in a

Progress? Does the future hold more for the woman of the Mission Station at Ooldea, South Australia (C. Bottomley, Australian Official Photo), than for her naked sister of the desert Center (author's photo)?

relatively short period considering the primitiveness of his tools.

The spear is the chief weapon of defense and hunting implement of the present-day Australian. Although the boomerang is very often mentioned as a weapon it usually plays a lesser part in his life. Contrary to general belief, most boomerangs are ones which do not return. Hunting boomerangs are thrown exactly as are the "rabbit sticks" of the Navaho Indians, which are, of course, merely another form of the boomerang. Specially made boomerangs which have the power to return when thrown are ones most often used in play, and are specially warped and twisted over a fire, to cause them to return. It is true that any ordinary boomerang suitably warped can be made to return as a Navaho rabbit stick also could when properly thrown.

In the Southeast of South Australia is the true home of the functional returning boomerang. This type of boomerang is used in association with large duck catching nets. As the birds fly towards the nets, which are strategically placed on flyways between lagoons and pools, a returning boomerang is thrown. It circles and hovers over the ducks far out over the water, before gracefully returning to the thrower who thus saves wetting his feet and can devote his attention to the ducks. Its purpose is to simulate a duck hawk in flight, and the flock of ducks alarmed so suddenly by its appearance overhead, may swoop down into the net set as trap for them.

The aborigines of Southern Australia were skilled makers of basket traps and fish nets, and they engaged in large organized hunts with nets and snares. A large emu catching net 59 yards long and three feet high was found by an early explorer in a cave along the Darling River. It still is in the South Australian Museum collection and testifies to great skill in such matters. The southern peoples also used cloaks of sewn skins as dress and as sleeping rugs. Use of such garments died out soon after they obtained Western blankets and today there are only a few surviving examples to indicate their skin-dressing techniques. The best and almost only known example of such a cloak is one in the U. S. National Museum at Washington. The people of the Desert Interior habitually lived

naked just like most of the people of the tropical North.

The days of these interesting people are numbered. Hunting days are gone; their very trees, shrubs and grasses are vanishing before the ravages of Western animals and pastures. The vast changes brought about by organized agriculture and forestry having spelled their doom, it is the anthropologists' mournful task to chronicle hastily the primitive wisdom the Australian aboriginal can offer to the archives of men and record their thoughts and beliefs before they vanish. They must work fast for the present repository of this knowledge is the minds of a relatively few old men and women now moving into their last years of life. Their children, in the few cases where they are born and grow up, seem to learn nothing of the old wisdom, preferring the life of the ranch and the learning which comes from exploring, say, the bowels of a worn-out automobile.

How few are their children? In a recent survey of the Njikena people of the Fitzroy River in Western Australia it was learned that though once this tribe numbered over 500 people, today there are fewer than 50 who remain. In the past 25 years only one female child has been reared to maturity and the youngest living full-blooded male Njikena man is just over 30 years of age. There can never be another generation of true Njikena and today few of the men of this tribe would have had wives, had it not been that the Walmadjeri people came from out of the Desert in the south and have given them daughters in marriage. It is tragic to realize that today the desert areas from which the Walmadjeri came are now depopulated and empty of people so that the story of the Njikena folk, in a few short years, will end in extinction, as will the stories of the many other tribes of these primitive people.

Of numbered days: This is Milerum, last of the Tanganekald tribesmen of the Coorong, South Australia, with his skin cloak, his club, boomerang, and the shoulder basket for fighting clubs. (Author)

End of the road? Old Tjinaputinga (Big Foot) of the Ngarilia tribe in the desert lands around Alice Springs, Northern Territory. Too old to re-educate, too steeped in his own tribal culture to absorb European ways, he represents the "aborigine problem" confronting the Commonwealth Government. (Australian Official Photograph)

THE MOUND BUILDERS

WHEN THE FIRST NAVIGATORS reached the East Indies and the coast of Northern Australia they were told, by the natives, of birds that laid their eggs in the sand and left them to be hatched by the heat of the sun. These stories, when repeated in Europe, were greeted with great scepticism. Later, in 1842, John Gilbert saw large mounds of sand in the arid scrubs of inland Australia and thought they were built by aboriginal women to amuse their children. It was not until a native removed eggs from such a mound that it was proved that these were, in fact, the nests of birds.

Since then more has been learned of the unique nesting habits of this family of mound building birds, the Megapodiidae. This article is a summary of the methods used by the Megapodiidae in incubating their eggs.

The members of this family lay their eggs in the ground, in heaps of fermenting organic matter, or in volcanoes, leaving them to be hatched by natural heat. The young hatch several feet under the ground, fully feathered, and at once dig their way to the surface. On reaching the surface they can run immediately and fly within a couple of hours. They are completely independent of their parents who they never see.

Nesting habits

The family is confined to the Mainland of Australia and the islands of Malaysia, Polynesia, and Micronesia and includes seven genera, three of which inhabit the mainland. The birds are all rather small, about the size of a domestic fowl, and dark in color. They are normally very timid and shy and seldom seen, unless great patience is used. They spend most of their time on the ground and only fly when very hard pressed. The food is native fruits and seeds, but details are not adequately known for any species. All species except one, *Leipoa ocellata,* are characteristically found in tropical areas with high rainfall and in heavy jungle. *Leipoa ocellata,* the mallee fowl, differs in that it is confined to the arid interior of Australia.

PAINTED MEGAPODES

The general term, which is correctly the vernacular name for one species, *Eulipoa wallacei,* has here been taken to refer to both *Eulipoa* and *Megacephalon.* Both are relatively highly colored, for megapodes, and have similar nesting habits.

Megacephalon. The sole species, *M. maleo,* is confined to the Celebes, and is commonest in the north arm of the island. *Megacephalon* has developed the simplest possible type of incubation: the eggs are buried in sand of a suitable temperature and left to hatch by this natural warmth. The bird lives in the mountains, in the interior of the island and, apparently, here the soil is not warm enough for incubation; there is, however, one account of nests being found in the interior near warm springs where the soil temperature was slightly higher. After the wet season the birds leave the mountains and walk to the sandy beaches, up to 20 miles away. On the beach holes are dug about 3 feet deep and a single egg laid. The birds return to the mountains and come back in a week or so to lay the next egg. The selection of a spot to dig the hole is important so as to place the egg in a suitable temperature; in this regard, it was noticed that the eggs were concentrated in an area of black sand on a beach — the white was not used. The black sand would be warmer, having better heat absorption. When the young hatch they walk alone to the mountains and never join up with their parents.

Eulipoa. The one species *E. wallacei* lives in the interior of the Moluccas and has similar habits to *Megacephalon,* laying in holes on the beaches. Very little has been recorded of its behavior.

BRUSH TURKEYS

Three genera have been grouped under the name brush turkey; they are all similar in appearance and nesting habit. *Alectura* inhabits the northern and eastern coasts of Australia, wherever rain forest is found, and the other two, *Aepypodius* and *Tallegallus,* live in the heavy jungles of New Guinea.

In the habitat of the brush turkeys there is much leaf mold on the forest floor and this ferments easily, and rapidly, under the humid heat. This is used by the birds in their nesting activities. The nest is a large heap of leaf mould that is scratched together in the dry season. The completed mounds measure about 12 feet in diameter and 3 feet high for *Alectura;* 10 feet in diameter and 5-6 feet high in *Aepypodius;* and 9 feet in diameter and 4 feet high in *Tallegallus.* Under the moist tropical conditions the leaf material ferments very rapidly and the internal temperature quickly reaches 120-140°F. when that of the air is only 60-70°F. This is a passing phase, however, and when the temperature has fallen somewhat, the eggs are laid. One egg is laid each third or fourth day to a full clutch of about twenty.

Throughout the season the birds regularly attend their mounds. In *Alectura* the male is in sole charge of the construction and maintenance of the mound and he savagely drives the female away, except on those occasions when she is due to lay an egg. As soon as she has laid she is driven off and the male covers it over and resumes his vigil. He works constantly, throughout the season, keeping the internal temperature at 90-95°F. He does this by digging into the center of

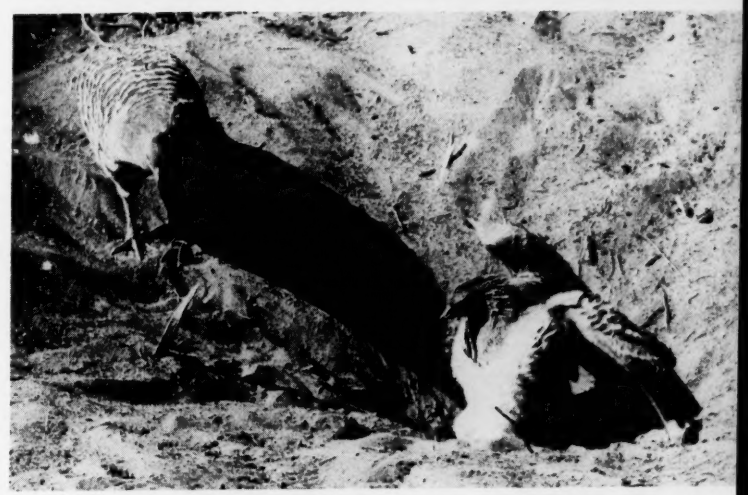
the mound, to allow heat to escape, if it is too hot, and adding fresh leaf material to the center to continue the fermentation when it is cooler.

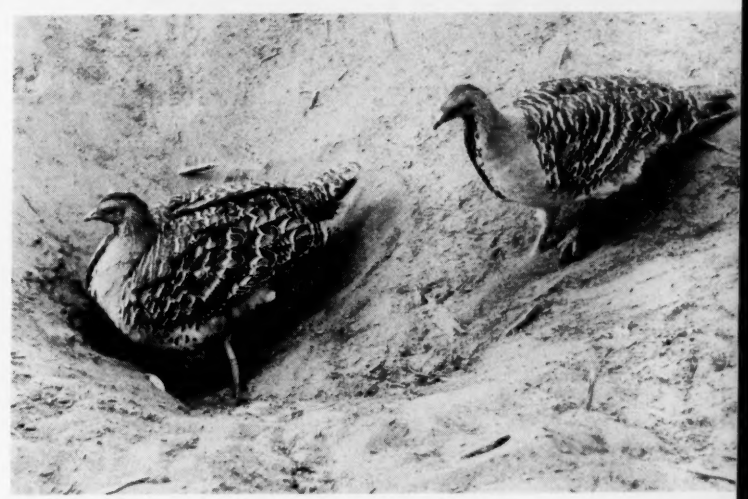
JUNGLE FOWL

The genus *Megapodius* is the most widespread of any, and comprises three species, *M. freycinet, M. pritchardi* and *M. laperouse*. While *pritchardi* is confined to Niaufou and Central Polynesia and *laperouse* to the Marianne Islands, *freycinet* is very widely distributed. The species ranges from the Philippines in the north to the Central Queensland (Australia) coast in the south, and from the Nicobar Islands in the west to the New Hebrides in the east. Included in the bird's range are tropical jungles, open forest with very small patches of jungle, volcanic areas and small rather bare coral islands; it has developed a separate type of incubation to suit each location.

The typical mound, as seen on the Australian coast, is built of soil or sand mixed with a moderate amount of leaf mould. The mounds are added to annually and often become huge, up to 35 feet diameter and 15 feet high. Several pairs of birds may take part in the building. There is no highly developed temperature regulation, as with *Alectura*. At the beginning of the season the old mound, now "dead," is scratched over and a layer of fresh leaf mould and soil added; when the first burst of fermentation is over the first eggs are laid. As the season proceeds and the heat generated by this layer declines, fresh material is brought in and successive eggs are laid in the warmer parts of the mound. There is, thus, a movement of the heated layer outwards, from the center, throughout the season. In New Guinea and the Solomon Islands a different type of mound was seen: here the eggs were laid in holes in the ground, the fermenting material heaped on top.

Where for some reason or other the soil is warm enough for incubation without leaf material, that is dispensed with. The best examples are on Simbo in the Solomon Islands where C. G. Sibley reported the birds entered the crater of a volcano and laid eggs in the warm ashes, a situation requiring no after care. On nearby islands without volcanoes, mounds were built. Similarly a volcano is used near Rabaul and Niaufou (by *pritchardi*). On Savo, in the Solomons, the island is jungle covered but there are two sand areas, heated by volcanic steam, which issues from the ground. Here the jungle fowl concentrate to nest—in these two areas, and nowhere else on the island. The natives are alive to this phenomenon and practice game management. The areas are divided up into family plots and a proportion of eggs are removed to be eaten; enough are allowed to hatch to perpetuate the stock.





MALLEE FOWL

Leipoa ocellata lives in the dry inland scrubs of Australia; it is closely associated with, although not confined to, the so-called mallee scrub, a sparse open scrub of dwarf *Eucalyptus*. The area has less than 14 inches of rain per year and, being

(TOP) Partly completed nest of the mallee fowl with organic matter heaped in the center before the final covering with soil. (CENTER) The male mallee fowl stands watch while his mate expels an egg. (BOTTOM) The new-laid egg is partly visible by the hen's foot. (Author)

A clutch of megapode eggs. (Author)

frequently swept by bushfires, it has very little leaf material on the ground — what there is, is bone dry and brittle. If heaped into a mound it does not ferment; it blows away or burns. Under these conditions it has been necessary for the mallee fowl to develop different and very complicated methods of incubation.

The nesting, which occupies almost the whole year, starts in April, when the old mound is cleaned out leaving a hole in the ground about 8 feet in diameter and 2 feet deep. Throughout June and July the male works and collects the small amount of leaf material on the ground over a radius of up to 20 yards around the mound. This is industriously swept up and into the hole until it is heaped up a foot or so above the soil surface. In July, there are usually a few showers of rain, and when the heap of dry leaves and twigs is moistened by such a shower, it is covered over with sand to a depth of a foot or so. The buried organic matter begins to ferment and the temperature of the mound rises rapidly.

Amazing temperature control

The eggs are laid in a chamber dug, centrally, into the mound. One egg is laid every four to eight days and the full clutch numbers 20-30 eggs. The incubation period is about 60 days. The first egg is usually laid at the end of August and the last egg hatches in mid-April. This means that eggs are in the soil throughout the spring with air temperatures of 60-70°F., in the summer with air temperatures of up to 120°F., and in autumn with air temperatures of 60-70°W. Throughout this whole period the birds maintain the temperature within 1-2°F. of the required incubation temperature of 94°F. To achieve this they have developed a rather complicated behavior pattern.

Their methods of regulating the temperature were investigated with physical instruments buried in the mounds. Close to a natural mound two artificial mounds were built — one, an exact duplicate of the natural mound; the other, without organic matter. In these three mounds, then, all the factors liable to affect the internal temperature could be separated. The natural mound was affected by birds, sun and organic matter; the artificial mound by sun and organic matter; the control by sun only. In each mound was buried a thermograph, to record temperature, and a flux plate, to record the direction and magnitude of any flow of heat. From these data and observations made at 15 other mounds it was possible to find out how the birds regulated temperature in the mounds.

It was found that, in the spring and early summer, when the sun was not very hot, the fermenting organic matter provided about 80 per cent of the heat reaching the eggs. So much heat was evolved by this buried material that the temperature continually tended to rise above the desired 94°F. The birds met this threat by coming to the mound each morning, before dawn, and removing the whole of the top part of the mound; several

→ Mallee fowl chick surfacing, after digging upwards for two hours. ↑ Three hours after leaving the mound. (Author's photos)

cubic yards of material were removed and the work took several hours. By thus opening the mound, in the cool morning air, there was a great movement of heat from the interior and a drop in temperature of the egg chamber. As soon as the mound was opened work was reversed and the sand, now cooled by the cool air, was returned to the excavation. The result of this work was that the temperature of the eggs remained at 94°F.

In mid-summer the air and the surface of the soil was very hot and no further heat was available from the organic material. The sun was able to provide sufficient, in fact too much, heat and the egg chamber still continued to slowly rise in temperature. In order to reduce the amount of heat reaching the eggs the birds built the mound up,

higher and higher, adding extra layers of sand, as insulation, until it was almost 4 feet high. This sufficed, for a time, but there was a slow increase in temperature of the egg chamber due to conduction from the surface and more drastic methods were necessary. As the temperature increased the birds would come to the mound before dawn, and dig all the soil out and then, immediately return it to the mound. This action upset the temperature gradient developing in the mound and covered the eggs with relatively cool soil of an even temperature and the egg temperature was maintained at 94°F. The action was necessary about once a week. On some occasions, in mid-summer, despite all their efforts the birds were unable to keep the temperature down and overheating occurred with loss of eggs. Throughout the whole period the main activity of the birds was devoted to keeping an adequate soil cover between the eggs and the sun. The male bird remained close to the mound all day and if the mound was interfered with immediately repaired the damage. At this time the normally timid birds became remarkably fearless, as is shown in the accompanying illustration.

In the autumn, the sun's heat was relatively feeble, not enough to hold the egg temperature unaided. The birds came to the mound daily, at about 11 A.M., when the sun shone directly on it, and dug away the soil cover to within about 2 inches of the eggs, allowing the sun to warm them. Throughout the day the male stayed at the mound and each hour returned an inch or so of sand, now heated by the sun, to the excavation. By 4 P.M. the mound had been restored with thoroughly heated sand and its internal temperature was maintained.

In any one of the above stages, if the birds were kept from the mound the temperature rapidly rose to too high a level in spring and summer, or fell to too low a level in autumn and the eggs failed to hatch.

Origin of mound building habit

It is usually thought that the incubation methods of the Megapodiidae are primitive and a reptilian survival. However, in the face of the highly complicated temperature regulation in the brush turkeys, mallee fowl, and to a lesser extent, the jungle fowl, I find this difficult to accept. It seems more likely that this is a highly specialized habit. It is thought the Megapodiidae were originally ground nesting birds, which developed the habit of covering the eggs when leaving them, and natural selection favored these individuals leading to the permanent adoption of the habit and subsequent complete dependence on it for incubation.

These areas inhabited, by the mallee fowl, were, before the Pleistocene, heavily covered with humid forests. It is thought the ancestors of the mallee fowl probably built a typical brush turkey mound. As the arid cycle has developed and the forests have been replaced by deserts the failure of the fermentation of organic matter has led to the development of methods of conserving this heat and of using that of the sun.

Male mallee fowl threatens the intruding photographer near his mound. (Author)

THE EUCALYPT TREE OF

THE GENUS *EUCALYPTUS* with its five hundred species besides some 150 known varieties is a characteristic feature of the Australian forests and woodlands which clothe at least 120,000,000 acres of the continent. Moreover, Eucalypts are essentially Australian — only a very few species occur on the islands to our north, and none in other parts of the world, except where they have been introduced.

Although each species has a definite climate or soil preference which limits it to a certain area, pure stands are rare. Usually several species associate together, one or more dominating the others; and together they dominate the landscape in most parts of the continent which get 12 or more inches of rain per year. The most favorable parts are those of higher rainfall, along the Eastern Coast, in the Southern Highlands, and in the southwestern corner of Western Australia. The most important commercial species flourish in these regions, and where the rainfall is good a profusion of undergrowth adds to the beauty of their forest stands.

The tallest eucalypts exceed 300 feet; the dwarf species reach four or five — it's mainly a matter of rainfall. The giants of the humid forest are tall and straight; the scrubs of the desert, the mallees, put out many brushy stems from a large water-storing root called a lignotuber. The genus is highly adaptable.

Just as habitat and habit vary, so do all the other characteristics of the genus. That is why there are so many species and why they are often hard to identify, even to the experienced botanist or forester. Leaves, fruit, and buds may be hanging 200 feet above ground. So the Australian botanist has special collecting gear — like end-weighted ropes to throw over the bottom branches, perhaps even a shotgun to bring down the highest specimens. Climbing is his last resort!

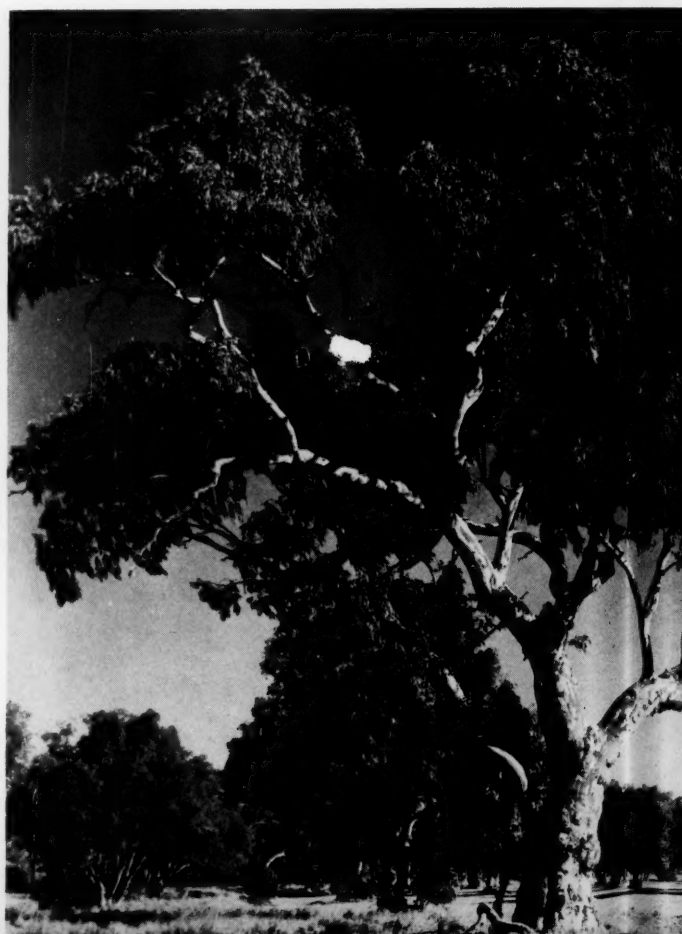
There are distinct types of bark — smooth barks (the "gums"), bloodwoods, stringy barks, boxes, peppermints, and ironbarks. The leaves change form from the juvenile to the adult tree, from opposite to alternate, and from silver-blue to dull green. Tips are often bright red in spring, transforming a whole forest spectacularly. In leaf size, venation, texture, and shape they have a vast range. Some are ribbon-thin; others are disks with the branch running through the center. Most have the same color and texture on both sides and hang pendant from the branches.

The unique flower structure is what sets the eucalypts apart. The sepals and petals of the bud are fused together into a cap which covers the stamens and surmounts the ovary and is pushed off by the maturing stamens. These are often bright yellow, pink, or red and make the flowering ornamentals so often cultivated.

The seeds of most eucalypts are very small, not unlike grains of black pepper or sand. It is amazing to think that a square mile of forest could be produced from a thimbleful of seed.

Because there is a eucalyptus for almost every climate from subalpine to desert, trees of this genus are now so common in many parts of the world as to seem almost native, serving for shade, windbreaks, erosion control, and wood. Often they grow better in the new home than in the old — their parasites are left behind.

As timber, some eucalypts are unsurpassable. With hardwood strength and resistance to decay they make excellent railroad ties, bridges, poles, and posts. A few kinds are commercial cabinet woods, and one, the wandoo, is a valuable source of tannin. Eucalyptus oil is a well known medicinal product; it is also used in mining to extract metallic sulfides by flotation. In Australia a newsprint industry is now thriving on eucalyptus pulp. And eucalyptus nectar makes a wonderful honey.



EE OF MANY GUISES

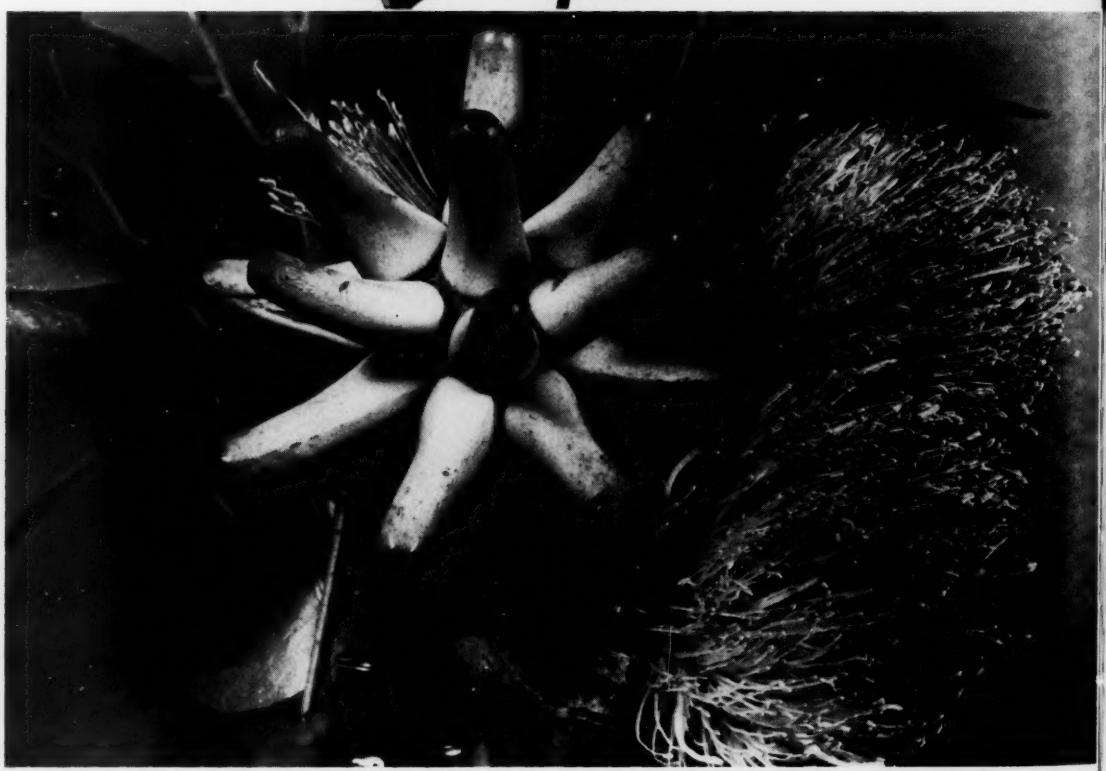
N. C. W. BEADLE

Just as in Australia the marsupials masquerade as many other kinds of animals, so the eucalypts take the habitat and habit of a varietyof other trees.

➔ The mountain ash, *Eucalyptus regnans*, is largest of the eucalypts. Highest official measurement recorded is 326 feet. With its undergrowth of ferns, this stately forest strongly resembles a California coast redwood grove, and like it is dependent on moisture. (Jack Gallagher, Aust. Official Photo)

➔ At first glance this parkland of ghost gums, *Eucalyptus papuana*, could be taken for a similar semi-arid parkland of oaks in the California Coast Ranges. The scene is the dry bed of the Todd River near Alice Springs in the heart of Australia. (Neil Murray, Australian Official Photograph)

Round-leafed snow gum, *Eucalyptus perriniana*, shows one extreme of leaf modification. A botanical curiosity, the tree grows to only 20 feet in the Alpine regions of New South Wales, Victoria, and Tasmania. It is sometimes called the "spinning" or "whistling" gum — the leaves tend to work loose and spin in a high wind with a loud whistling sound. As the tree ages, the leaves take on a more normal shape. (Australian Official Photo)



The bushy yate, *Eucalyptus lehmannii*, is popularly called the "finger-stall gum" from the thimble-like buds. The cap is actually fused petals and sepals; the blossom itself consists of the stamens after the cap drops. (Ken Dicker, Aust. Official Photo)

← The mottlecah, *Eucalyptus macrocarpa*, grows on the high sandy plains of Western Australia. Flowering from October to December, its blossoms are 3 to 4 inches across. The 2–2.5-inch fruit is largest of all eucalypts. (Jack Gallagher, Australian Official Photograph)

↓ Ribbon gums, *Eucalyptus viminalis*, on the Northern Tablelands, New South Wales. Again, the similarity to California oak-grassland is striking. (Furnished by the author)

MARSUPIAL MASQUERADE

HAROLD C. REYNOLDS

THE AUSTRALIAN REGION, it has been stated, is a "colossal natural history museum stocked with living fossils." Since white men first discovered New Guinea, Australia, and Tasmania the mammals of that area have gained the reputation of being novelties. Not only is this because they include the most primitive furred animals of the world, but also because of the fact that some of these primitive species are among the most highly specialized ones we know today. Even more interesting, perhaps, is the amazing way in which they have paralleled the advanced placental mammals on other parts of the globe.

The monotreme (egg laying) and marsupial (pouch bearing) forms that occur so commonly there have caused scientists to speculate widely regarding several still unanswered questions: One is, how did they get to these, now isolated, parts; another, why have they been so successful in this limited area while their relatives elsewhere in the world have, for the most part, become extinct thousands of years ago? Of the ten living families of monotremes and marsupials in all of the world, eight occur only in the Australian region.

Tasmania appears to be the last stronghold for several members of these groups which have become greatly reduced in numbers or have vanished from their previously greater range in Australia. With the lesser disturbance of their natural habitats by man in Tasmania, they have had a much better chance for survival there.

Most primitive of the world's mammals are the spiny ant-eater (*Tachyglossus*) and platypus (*Ornithorhynchus*) which are the only living mammals that lay eggs. In the absence of fossil records to show their ancestry, it is a mystery from whence they came. Although they are closely related, they are very different in appearance and in habits: The spiny ant-eater has become a highly specialized terrestrial form while the platypus has become equally specialized for amphibious existence.

The spiny ant-eater uses its elongated snout as a probe in search of small insects in the soil. Its powerful forelimbs and claws aid it in finding its food by enabling it to scratch shallow pits in the ground. When clinging to rough surfaces, digging themselves into the ground, and wedging between objects when frightened, their strength is remarkable. Recently I put one into my car where it immediately went for the springs under the front seat, from which it took me almost an hour to dislodge it. Its chief protection is its covering of sharp spines on the upper surface of the body and tail. In addition, when torn from the substrate, it has the ability to roll into a spiny ball. After the first experience very few dogs even will touch one. The egg of the female is carried in a temporary abdominal pouch where, after hatching, the young one remains until the spines become a problem for the mother. Hence, it is left in a hollow log or some similar retreat where the parent returns to nurse it. A primitive con-

Tasmanian devil, Melbourne Zoological Gardens. (Jack Gallagher, Australian Official Photo)

dition in the monotremes is the absence of nipples; the milk merely oozes onto the hair where it is lapped up by the young.

The platypus, when first discovered, was considered the freak of all freaks, having a beak and webbed feet resembling those of a duck, hair similar to that of a mole and a flattened tail like that of a beaver. Furthermore, the males had spurs on the hind legs which resembled those of a rooster. Scientists of the day were very skeptical of this extraordinary animal which was brought to them in the form of skins. In 1823 a publication included the following statements: "They reached England by vessels which had navigated the Indian seas, a circumstance arousing the suspicions of scientists, aware of the monstrous impostures which the artful Chinese then practised on European adventurers – these oriental taxidermists were quite notorious for their skill in constructing non-existent animals for sale to credulous seamen, such as the so-called "eastern mermaid," to be seen occasionally in curiosity shops to this day, consisting of the forepart of a monkey skilfully stitched to the tail of a fish." Eventually, it was proved that, not only did the platypus actually exist but, in addition to its other unusual combination of features, the spurs of the male were associated with poison glands quite like those of a snake and the female laid eggs and produced milk.

It is believed generally that the platypus lives in water, but actually this is not the case; it merely feeds in the water for a few hours of the 24 and the remainder of the time it lives in burrows, well above the water level, in the banks of streams and rivers. Like the spiny ant-eater, it feeds on insects and other invertebrates but, instead of obtaining these from soil on land, it finds them in the mud of the bottom of water courses. Fishermen commonly believe that it eats fish, but this never has been proved. The eggs of the platypus, like those of the spiny ant-eater, are more or less rounded and less than three-quarters of an inch in diameter. They are covered by a leathery substance known as keratin instead of the fragile, calcareous shell of the eggs of birds. The platypus has no pouch in which to carry the eggs or young. Instead, the female lays her eggs, usually two in number, in a special nest chamber in the burrow where she incubates them and secretes milk for the young after hatching.

Most primitive of Tasmania's marsupials are members of the Family Dasyuridae, the forms most closely related to the American opossum. Interestingly, this family includes the so-called marsupial mice, cats, and dogs whose counterparts among the placental mammals are quite unrelated.

Despite their mouse-like appearance, the Tasmanian "marsupial mice" (*Antechinus* and *Sminthopsis*) really are not mice at all. Their structure is quite different from that of the rodents. In fact, on the basis of their habits, it would be much more logical to call them "marsupial shrews." They don't even feed on grains and other types of vegetation as the rodents do; instead, their diet consists chiefly of insects and small lizards.

The native cat (*Dasyurus*), the tiger cat (*Dasyurops*) and the Tasmanian devil (*Sarcophilus*) are con-

World's only egg-laying mammals:
▲ The echidna or spiny ant-eater.
(Jack Gallagher, Australian Official Photo)
◄ The platypus — awkward on land but he swims with the greatest ease. (Author)

Native cat. ➔ Tiger cat. (Author)

sidered to be the only living carnivorous or flesh eating predatory marsupials in all of the world. There is one possible exception and that is the Tasmanian wolf (*Thylacinus*).

The native cat is a cunning little animal and probably the most intelligent of the Tasmanian marsupials. When reared in captivity it is said to make an excellent pet with the playfulness of a domestic kitten. Native cats commonly live near cities and frequently come to timber and mining camps in search of any scraps that they can find, but in the wild their diet consists chiefly of insects, lizards, and small birds and mammals. The usual color is tan with light spots, but in some individuals the chief coloring is black. In habits and in appearance this animal has paralleled the American spotted skunk, but without the odor.

The tiger cat generally is a much larger animal than the native cat and easily can be distinguished from it by the presence of spots on the tail. Also, in habits it is

quite a different animal, being more shy, more arboreal and having a diet which apparently consists entirely of meat. In some places tiger cats become quite a problem for poultry keepers as when an individual once gets started on the fowls, it will continue returning until it has taken the last bird. Their appetites are tremendous. Recently I caught one which the night before had taken 14 ducklings and the old hen that was brooding them.

Although it once lived on the mainland of Australia, the Tasmanian devil, as the name implies, now is restricted to Tasmania. It looks somewhat like a small black bear, but usually has a white patch on the rump and another on the throat or shoulder region. It has short legs and is relatively slow in running. The devil probably is the most secretive of all of the larger marsupials of the Australian region. Even the old "bushmen" who live where these animals are common and frequently catch them in their traps and snares, if honest, will admit that, of all the native mammals, they know least about the devil. They don't know where they sleep, what they eat or little else about their habits. Even among those who hunt with dogs in "devil country," I know of no record of one having been flushed from its sleeping quarters. Stomach contents and droppings show that they eat a wide variety of animal material but the question is "how do they catch it?" No doubt they are truly scavengers, eating any animals that they find dead including other devils, and, being unable to run rapidly, it seems likely that they might lie quietly beside the runways and spring upon any unfortunate passer-by. In any case, they must get their food easily. I have yet to see a skinny devil and recently I caught one with only three legs which was a bundle of fat and weighed 25 pounds, the maximum of any I have encountered.

Probably the foremost question concerning the mammals of this region is "does the Tasmanian wolf or tiger (*Thylacinus*) still exist?" Generally it is believed that these animals became extinct about 1930 but there are some people who believe differently. There

The devil himself. (Author)

The pygmy possum. (Author)

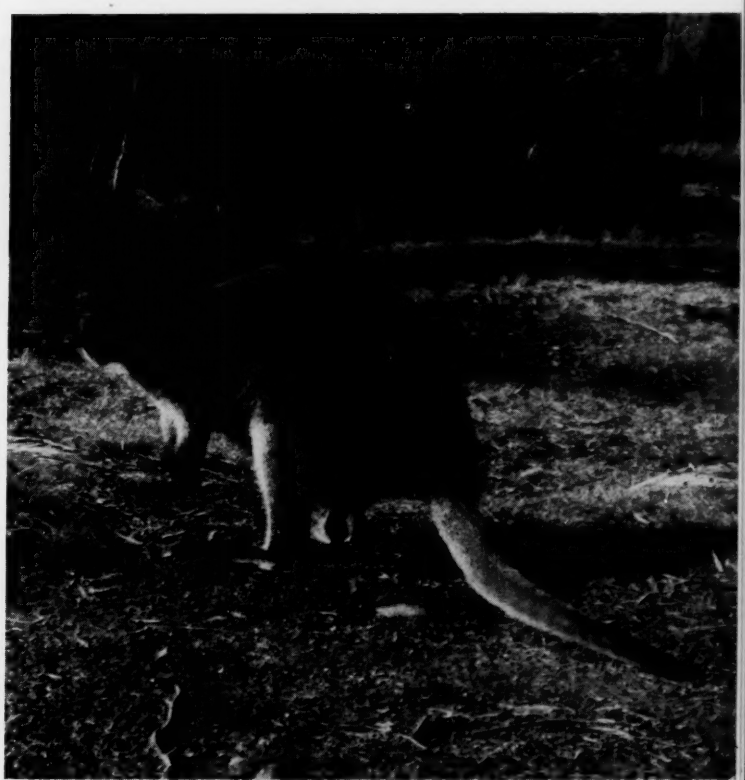
are some who claim that they have seen them and even caught them in recent years. Yet, there is no photograph nor specimen of one collected within the past quarter of a century, even though permits have been issued and elaborate parties have made expensive attempts to get them for zoos. This has included even the transportation into the wilds of Tasmania of live sheep for bait. The Tasmanian wolf, the largest recent carnivorous marsupial, is about the size of a greyhound dog, and of a fawn color with darker stripes on the lower back and rump region.

The bandicoots display a unique combination of features in having teeth similar to those of the insect- and flesh-eating marsupials and the specialized foot structure of the kangaroos. Of the recognized genera of the bandicoots, only two now exist in numbers and both are common in Tasmania. These are the short-nosed or brown bandicoot (*Thylacis*) and the long-nosed or striped form (*Perameles*). Their habits are much the same but their habitats, although they overlap, essentially are quite different. They both feed on insects, insect larvae, and worms which they get by scratching small pits in the soil. Both build nests consisting mainly of grass under low vegetation. The short-nosed bandicoot is a scrub-loving type, while the striped bandicoot, on the other hand, tends to restrict its range to the open pastures. Of all the Tasmanian marsupials, the striped bandicoot seems to have profited most by man's activities in clearing the land for farming. Also, the introduced European rabbit seems to have helped it by digging burrows in which it can find easy refuge if not permanent shelter.

The Tasmanian phalangers are of several forms commonly referred to as "opossums." Actually, there are no opossums there and it is only on the basis of superficial resemblance and the primitive structure of the feet, like those of the American opossum, that they have come to acquire the name. Recently, it has been proposed that these animals in the Australian region should be called "possums" in contrast to "opossums" which is the name given to the American marsupial by the American Indian.

The smallest of the group and, as a matter of fact, one of the smallest of all living mammals is the pigmy possum (*Cercaertus*). Among five adult individuals of the little Tasmanian species that I have collected recently, the average weight was only a little more than one-quarter of an ounce each. They make their homes in dry hollows of dead trees in which they build bulky nests of moss and fine strips of bark from gum trees. Their food appears to consist of insects and the nectar from flowers.

The gliding phalangers illustrate one of the most interesting examples of parallelism found in all living mammals. Some of them are so much like the flying squirrels of Europe, Asia and North America that, from their skins alone, they are hardly distinguishable. It



↑ Brush wallaby, miscalled kangaroo because of his size.
← Brush-tailed possum. (Author's photos)

seems incredible that two forms which are so distantly related possibly could be so much the same in appearance and in habits.

The sugar glider, the smallest species, is the one of the group found in Tasmania. Owing to a flap of skin on either side of the body which extends from the front to the hind legs, these little animals, measuring only about six inches in body length, have the ability to glide for as much as 50 yards from tree to tree. Their homes are in hollow trees and they feed on insects, flowers, and native fruits when in season.

The two larger forms of phalangers in Tasmania are the so-called ring-tailed possum (*Pseudocheirus*) and the brush-tailed possum (*Trichosurus*). Unlike the previously mentioned members of the family, these possums are vegetarians, living chiefly on the leaves of eucalyptus trees. Although their food habits are much the same and often they are found living side by side, there seems to be little competition between them. Apparently this is because there is ample food for both and their denning habits, though they overlap, are, for the most part, quite different. The "ringie" is a nest builder and constructs a home similar to that of the American tree squirrels or lives in small hollow branches while the "brush possum" depends entirely upon larger hollow trees and rocky caverns for its shelter. The situation is much the same as that found in the opossum-raccoon relationship in America.

In Tasmania the wombat (*Phascolomis*) is called the "badger." Aside from the fact that both of these animals dig burrows, there is little resemblance between them. The wombat, which is a grazer, is in general appearance quite like the capybara of South America. It is about the size of a half-grown hog and has tremendous power. It probably would require more than a half-dozen men to hold one down. Woe be the dog which follows one into a burrow and attempts to kill it there. The wombat merely waits for the dog to get a grip and then crushes it against the wall with its head, rump, or shoulders.

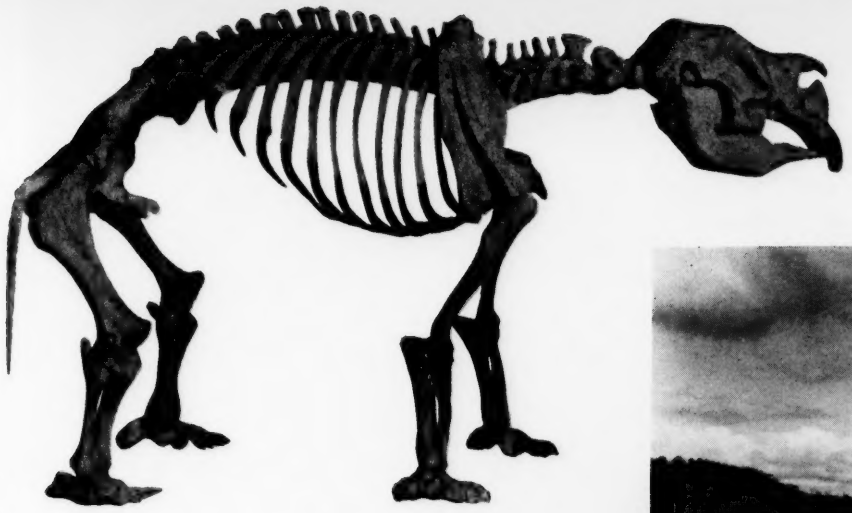
The kangaroo group is the most highly developed one of the Tasmanian marsupials. Of the five different forms, the smallest are the rat-kangaroos (*Bettongia*) and (*Potorous*) which are about the size of a domestic rabbit. Commonly they are called "kangaroo-rats," "wallaby - rats," "brush - rats," "jerboa kangaroos," "squeakers," "tungoos," "boodie rats," etc. They seem to have more common names than any other of the marsupials while, at the same time, their habits are among the most poorly known. They live in brushy country and are said to feed on herbage and tuberous roots but there is a great deal more to be learned about them.

There are two wallabies in Tasmania — one, the brush wallaby (*Protemnodon*), because of its large size, is called "the kangaroo"; the other, the red-bellied pademelon (*Thylogale*), is known as "the wallaby." Although their feeding habits in grazing and browsing are much the same and their habitats overlap considerably, fundamentally they are quite different animals. The larger form, which in my personal collecting has proved to attain a total length of at least 5 feet 3 inches, is an edge animal, living on the border between brush and open areas, while the pademelon, whose maximum size is only about twice that of a hare, is at home in the dense brush. For protection the pademelon, with short legs, depends upon dodging its enemies in its network of runways in the thickets instead of attempting to outrun them in the open as does its bigger relative.

The largest of all the Tasmanian marsupials is the forester kangaroo (*Macropus*) whose range in recent years has become quite restricted. This primarily is due to the clearing of its natural habitat for farming and to its size, comparable to that of a human being, rendering it an irresistible shooting target.

The monotremes and marsupials of Tasmania are extremely interesting animals. Fortunately, despite the shooting, trapping, snaring, introduction of the European rabbit and clearing of the land they have been able to carry on. Let's hope that they continue to do so.

Tasmanian wolf, a Melbourne museum mounted specimen. (Courtesy ANIB)



← *Diprotodon*, restored skeleton. (Copyright, South Australian Museum)

↓ Darling Downs — King's Creek valley with basalt-capped hill.

JACK T. WOODS

PAST AND PRESENT ON THE DARLING DOWNS

QUEENSLAND'S DARLING DOWNS hold in rolling hills and watercourses a million years of Australian history. Wheatfields tell of the modern day; beneath, rich fossil beds reveal the story of animal life all the way back to the Great Ice Age, in the Pleistocene of paleontologists.

In 1827 an exploring botanist, Allan Cunningham, first saw and named the Downs when he journeyed northward from the settled parts of New South Wales in search of new grazing lands. The name now embraces a wide region, beginning 90 miles by road from Queensland's capital, Brisbane, flanked on the east by the Main Range which presents a steep seaward scarp to the coastal plain. Westward, the gradient is gentle and the undulating Downs merge with the western plains of the state. Much of the area lies within the watershed of the Condamine River, which is part of the vast Murray-Darling river system of eastern Australia.

Settlement began in 1840, when pastoralists drove their flocks northward and established holdings on the rich grasslands Cunningham reported. Others soon followed and the pastoral industry thrived in these permanently watered lands. It was not until three decades had elapsed that the industry began to lose its dominance to agriculture and dairying. Queensland had been separated from the colony of New South Wales in 1859 and increased immigration had led to the closer settlement of the Darling Downs, with more economic utilization of the land. The trend towards increased cultivation has continued and the million acres, which are cropped, are recognized as one of the finest tracts of agricultural land in the world.

Grain crops, notably wheat, are dry-farmed, for while the annual rainfall averages nearly 30 inches, most of this falls in summer and not in the growing season.* Notwithstanding, wheat yields per acre are higher than in the more temperate states, returns of twenty bushels often being recorded. Dairy cattle get supplementary grazing on fodder crops, while in the western part of the region, with poorer soils and lower rainfall, large numbers of beef cattle and sheep are maintained.

*In southern Queensland the growing season for wheat is June-December, the Australian winter and spring.—ED.

On the eastern Downs, the heavy black and red-brown agricultural soils had their origin in the denudation of a plateau of basaltic volcanic rock. Remnants of the plateau still form the cappings of the adjacent ranges and flat-topped hills which characterize the local scenery. The richest soils occur in the wide alluvial terraces of the tributaries of the Condamine.

In the spacious fields one may sense the passage of time only in the movement of men and machines, or, perhaps, in the seasonal response of the soil to the growing crops. It is easy to forget the history of little more than a century ago, when the pioneering overlanders and their flocks began to displace the aborigines and the abundant life of the plains. Few even wonder at what may have passed before. Just as the events of each part of the written history have transcended those which preceded them, so it seems likely that the early dark-skinned Australians saw the passing of another phase – the age of the giant marsupials.

The majority of the native mammals of Australia are marsupials or pouch-bearers. Before the advent of European civilization, they flourished in the absence of serious competition from the more highly organized placental mammals, which are dominant in other lands. There is no doubt that the marsupials have had a long geological history in Australia, but apart from the work of Dr. R. A. Stirton, little is known of the early representatives of the group. Numerous fossils have been recovered, however, from deposits of the Pleistocene period, extending over the last million years, many of them from the Darling Downs.

▲ Bedded alluvium, Condamine River bank at Macalister.
➔ Fossil-hunters' camp on the Condamine, Macalister.

In the eastern part of the region, the fossil-bearing beds, outcropping in the banks of creeks and gullies, are associated with the alluvial soils. These soils have contributed in two ways to the preservation of the remains of animals of another age – in their fertility they sustained adequate vegetation for a large and varied population of herbivorous marsupials in life, and in their erosion and redeposition on the flooded terraces of the streams of the time, they served to trap the bones of many after death.

No complete skeletons have been found in these stream deposits; most of the fossils are fragments of single bones. This kind of deposit is in contrast with that at Lake Callabonna in South Australia, described by Dr. R. A. Stirton in a previous number of this journal.* Here large numbers of complete skeletons are preserved in the silt, where the animals apparently mired as the waters of the lake receded.

A few years after settlement had begun, the first specimens from the Darling Downs reached Sir Richard Owen, the renowned anatomist and vertebrate paleontologist, in London. Owen had earlier described the first fossil marsupials found in Australia, in the Wellington Caves west of Sydney. Among these were bones of the largest of them all, which he named *Diprotodon.* This extinct giant was comparable in size with a rhinoceros. It is curious that, when he received remains of the same animal from the Downs, he, at first, mistook them for evidence of a sometime large mastodon-like mammal on this continent.

It is recorded that the settlers regarded the search for these fossils along the creeks on their extensive properties as a diversion, and there was some rivalry among them. Soon large collections of fossils had been sent to Owen. He described *Nototherium,* a heavily built marsupial quadruped, three-quarters of the size of *Diprotodon.* The arrangement of the teeth of these great herbivores

*"Digging Down Under," *PD,* March-April 1954.

Past and present:
← Sir Richard Owen. (From an old engraving)
↓ The author and a notothere skull.

resembled that of living kangaroos. The molars were heavy, up to two inches in length, and carried two transverse ridges for grinding, while the protruding incisors were separated by a gap from the cheek-teeth.

Collecting methods were definitely haphazard and little information on their occurrence accompanied the descriptions of the fossils. Ludwig Leichhardt, the naturalist and explorer, fated to die later in the harsh interior of the continent, trekked over the Downs on his first trans-continental expedition in 1844 and his journal contains the first brief account of the geology of the area.

In the fifties and sixties, numbers of fossils continued to be found and with few exceptions were sent overseas. No Australian workers had the sustained enthusiasm or the anatomical knowledge to compete with Owen; and the collectors, the men on the land, no doubt enjoyed the glamor attached to the publication abroad of the fruits of their amateur labors. The field geologists of the time, when they traversed the Downs, had the search for gold as their prime objective.

Apart from the giant nototheres, Owen described remains of extinct wombats and kangaroos, many of them larger than living species, and he was particularly interested in fossils of that problematic marsupial, *Thylacoleo,* the pouched lion. The animal was strongly built and about the size of a jaguar. Owen studied its elongate, blade-like cheek-teeth and concluded that, while the animal belonged to the same group as the large herbivorous marsupials, it was in reality carnivorous. Many paleontologists have disagreed with this interpretation but recent detailed studies on the anatomy of the skull substantiate his view. *Thylacoleo* had a place as an active predator in the fauna, in the maintenance of the balance of the populations of giant herbivores.

During the eighties, the expanding Queensland Museum was able to put collectors in the field and in the decade beginning 1885 Kendal Broadbent and Henry Hurst obtained large numbers of fossils. C. W. De Vis, who was Curator of the Museum, described many new species, including several extinct kangaroos. The collectors did much of their work near Chinchilla, on the western fringe of the Downs. It has lately been realized that fossils from this area are rather different from those

of the Pleistocene deposits further to the east and it is thought that they may have been derived from animals which lived in the preceding geological period, the Pliocene, ranging back between one and eight million years.

The beds at Chinchilla consist of sands and grits, exposed in the high banks of the Condamine River and in the gullies running into it. Initially, they must have been very rich, for it is recorded that, in 1887, Broadbent returned with a collection of some 2,441 specimens and, although many would have been virtually worthless fragments, anyone who works the Chinchilla Formation for fossils today will view the figure with awe and envy. I have spoken with an old man who, as a boy, scouted the dry gullies in search of specimens for Kendal Broadbent. He recollected that one spot was known locally as "Fossil Gully" because of the abundance of bones there.

The fossil beds of the Darling Downs show that

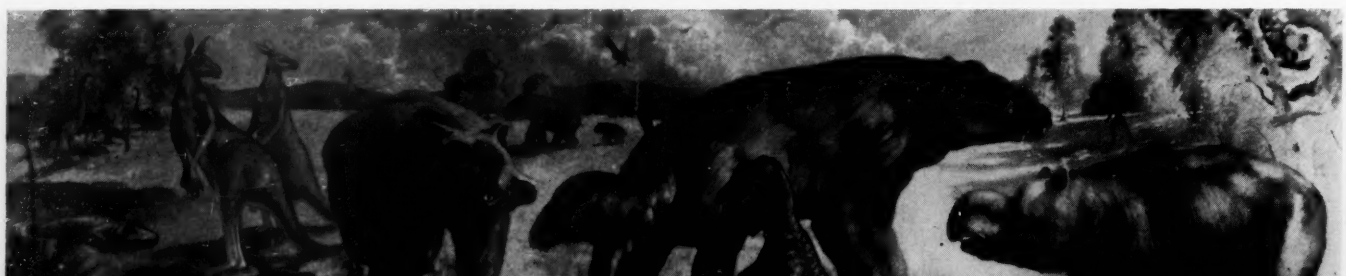
other groups of vertebrate animals flourished as well as the marsupials. While their remains are rare, the unique egg-laying mammals, the monotremes, are represented by fossils of extinct forms of both platypus and echidna. The abundant birdlife of the times included flightless forms even larger than the living emu. One problematic fossil, a fragmentary limb bone, has been assigned to the moas, that group of large flightless birds known only from New Zealand where they became extinct in geologically recent times. Some of the reptiles were also of large proportions. *Pallimnarchus,* the extinct fresh-water crocodile, is believed to have grown to a length of twenty feet. Fragments of its jaws are not uncommon in the Condamine deposits at Macalister. *Megalania,* related to the living varanid lizards or goannas, was nearly as large. The horned tortoise, *Meiolania,* must have been of remarkable appearance. Only two specimens have been found in Queensland, a skull, which was about twelve inches in length, and a portion of the armored tail-sheath. Both specimens are in the British Museum. At Chinchilla, dental plates of a lung-fish have been found which are very similar to those of the living species. This interesting fish, now restricted to two coastal rivers of the state, ranged over much of the continent during its long geological history.

Old records show that the productivity of the fossil beds declined in the nineties. The ground had been well trodden by the early collectors and the superficial material had been removed. Apart from this, fifty years of settlement and especially the swing to agriculture, had brought changes to the land itself. The disastrous floods which swept Queensland in 1893 started silting of the deep holes along the creeks where some of the best exposures were. Others became obscured by the spread of introduced weeds. This state of affairs has continued to the present and, while erosion on the Downs has never reached catastrophic proportions, any loss of topsoil, which has been able to produce good yields of grain crops for eighty years without fertilization, remains a tragedy.

In spite of the universal realization of the significance of these extinct forms as the forerunners of the present land animals of Australia, no attempt at their systematic collection was made in this state during the first half of the century. However, some important specimens have been added to the collections, mainly through the efforts of country people whose curiosity was aroused by the discovery of some strange bone. Most notable of these was the nearly complete skull of the notothere, *Euryzygoma,* which was recovered from a depth of 70 feet during well-sinking operations at Brigalow, near Chinchilla on the western Downs. The length of this skull is over two feet and its maximum width, across its unusually developed lateral processes, is even greater.

Much of the land between Chinchilla and Brigalow had, up to twenty years ago, lain useless under a heavy infestation of prickly-pear. Introduced from America in the last century, this cactus flourished in its new environment, and rapidly became a pest. After several attempts at biological control had failed, the cacti, over a few years, succumbed to attacks of the larvae of the moth, *Cactoblastis,* brought in from Argentina. Man had won this battle with nature and the small dairying community at Boonarga in the district remembered the insect when it named a new recreational hall "The Cacto-blastis Memorial Hall."

The story of the prickly pear is now part of the written history and, to a visitor to the district, if it were not for the memorial hall or perhaps the sight of a few unhealthy clumps remaining, it is history that might easily be overlooked. In reality, it is a good example of man's propensity for changing, in a few years, the face of the land. Again, when we think that the majority of the mammals of a century ago have left the settled parts of the



HEAVEN'S OTHER HALF

GOING SOUTH for the *winter*?—or for the *summer*? The question is far more involved than it appears. If you are planning to follow the sun and spend the Christmas season in Acapulco or spend January and February in the Caribbean, the question is answered one way. If you are thinking of Tahiti, or New Zealand, or Sydney for the same period, then the question may be answered differently. At 1:00 P.M., P.S.T., on December 21, 1956 autumn will end and winter will begin in our part of the world. At the same instant of the same day spring will end and summer will begin in the Southern Hemisphere. What could be more logical or more obvious? When the sun leaves the northern lands, it moves to the southern half of the world, and the seasons are completely reversed as we move from one hemisphere to the other. One step across the Equator can shift us six months in seasons if not in time.

Just as the newest of the "new world" lies south of the Equator, so do the "new skies" look down upon the southern half of the world. The stars and constellations trace their names and history so far into antiquity that many of their origins are unknown. The stars in most of the sky were named by people who lived in the Northern Hemisphere. The groups of stars, as far south in the sky as they could see, were imagined to form outlines of people and creatures who stood erect as seen from the northern part of the world. From the Southern Hemisphere these same constellations appear upside down.

There was a circular area of the sky surrounding the south pole of the heavens which never rose for the people who lived in the ancient lands of the Middle East, and it remained for the explorers of relatively modern times to assign names to the stars and constellations of that area. These constellations bear rather modern names: *Crux*, the (Southern) Cross; *Pictor*, the Painter's Easel, and *Triangulum*, the Triangle.

A magnificent southern sky awaits the visitor during the months from November through March or April. During this period, especially during the latter portion, a band of bright stars is spread across the sky, following closely the faint background of the Milky Way. Many of these can be picked out easily on the accompanying map: *Canopus* in Carina, *Alpha, Beta,* and Gamma Crucis in the Southern Cross, and Alpha and Beta Centauri in Centaurus. The map covers only the area within 40 degrees of the pole, and much of the northern sky is actually visible from intermediate southern latitudes. This band of bright stars runs on to the north and includes stars familiar to us, such as: *Sirius* in Canis Major, *Procyon* in Canis Minor, *Betelgeuse* and *Rigel* in Orion, *Aldebaran* in Taurus, and *Capella* in Auriga. These are among the brightest stars in the sky, and the band is enhanced by many other stars of slightly lesser brightness. The three brightest stars in the sky, Sirius, Canopus, and Alpha Centauri, are all visible at once.*

Some of these stars are remarkable in themselves. Beta Centauri and Alpha and Beta Crucis are very hot stars—blue in color. Beta Centauri gives more light than 3,000 suns. Canopus is not much hotter than the sun but gives the light of 80,000 suns! As amazing as these figures seem, these stars are pikers compared to S *Doradus*, a southern star so distant it is invisible to the unaided eye. It is the most luminous star known. It is known to consist of two stars in orbital motion about each other, and each of them is as bright as 250,000 suns. It is a double giant, each star as big as the orbit of Saturn, 1.5 billion miles in diameter.

S Doradus lies within a great cloud of stars known as the *Greater Magellanic Cloud*. The Greater and Lesser Magellanic Clouds appear as detached sections of the Milky Way, and for some time this is just what they were suspected of being. It was discovered in 1953 that they are twice as far away as they had previously been thought to be. This means that they are also twice as big as previously thought, and they now assume the dimensions of small galaxies. They contain unusually large numbers of giant stars—both giant in size and in luminosity. S Doradus is the greatest of these, a giant among giants. But to the unaided eye, even S Doradus is not visible as an individual star in the cloud. The distance is much too great.

Far more famous than the Magellanic Clouds is the Southern Cross. Almost everyone who travels southward across the Equator searches the sky anxiously for

*Recent measurements of the brightest stars by photoelectric means have reshuffled their brightnesses. Alpha Centauri has been moved from third to seventh place, and Arcturus, Vega, and Capella are now known to be brighter.

Downs, with less trace than those that lived a million years ago, it is emphasized to us that his changes are often more drastic than those of nature.

The full story of the age of the giant marsupials on the Darling Downs is, of course, yet to be told. In order to fill a few of the gaps, I have revisited some of the collecting grounds which yielded so many specimens in the last century. Once a knowledge of the faunal assemblages – the animals which lived in different regions at different times – is built up, it will be possible to trace the succession of the faunas, their evolution and migration, and their relation to their environment. The solution of these problems involves a study of the fossil-bearing sediments themselves, as well as the fossil remains. The task will be lengthy – suitable specimens are not readily found – but the example of the work of some of the American vertebrate paleontologists is before us.

Mural at the Department of Geology, University of Queensland, depicting life on the Darling Downs in the age of the giant marsupials. The three largest animals are (LEFT TO RIGHT) *Euryzygoma, Diprotodon,* and *Nototherium*. Coming up to land (EXTREME LEFT) is *Pallimnarchus*, the fresh-water crocodile. The wolf-like animal with bared fangs (LEFT FOREGROUND) is Thylacoleo; and in the foreground are the horned turtle *Meiolania*, and saurian *Megalania*. (Painted by Don Cowan and Quentin Hole)

the cross. It is almost always necessary for the cross to be pointed out to the traveler, because the group enjoys a fame greater than its size. It is a modest group, occupying far less area of the sky than does the Big Dipper. It consists of five stars, four of which mark the extremities of the cross, and the fifth, a faint star, is close to the intersection of the arms of the cross, but displaced slightly to the lower right. The brightest star is at the foot of the cross. It is known as Alpha Crucis, or by the proper name of "Acrux." The second brightest is at the left extremity. It is nearly as bright as Alpha, and is known as Beta Crucis.

There is another configuration of stars not very far from the cross which resembles it rather closely. It lies partly in the constellation of Vela (the Sail) and partly in Carina (the Keel). It is often mistaken for the true cross and is called the "false cross." It is a larger configuration but its stars are not as bright as those of the true cross. One can be sure he is looking at the true cross if the "pointer" stars, Alpha and Beta Centauri, are visible. These two very bright stars point almost precisely to the top of the cross.

The Southern Cross lies in the Milky Way. When the cross is seen in an erect position, adjacent to it at the lower left is seen a particularly dark area in the Milky Way. It is about the same size as the area of the cross itself. Early Mariners called it "the Coal Sack," and the name is used today. Such dark regions are

STARS OF THE SOUTHERN HEMISPHERE. The two concentric circles between the center and the edge of the chart each mark 30 degrees of declination or latitude on the celestial sphere. Roman numerals indicate right ascension or longitude. The stippled band is the Milky Way. This chart is reproduced (with additions) from the *Scientific American*, September 1956, by permission; the original was drawn by Bunji Tagawa. Followers of our Astronomy department should see this splendid extra-large special *Scientific American* issue on "The Universe."

On going to Australia

Family at Sea. By John Caldwell. Little, Brown & Company, Boston. 1956. 309 pp., endpaper map. $4.50.

There are three ways of getting to Australia – by air, by ship, and by the do-it-yourself method. The first two are commonplace, needing no comment. If one takes the last, to the extent of sailing his own small boat from America, he is more than likely to write a book about it. If he makes Australia, he is probably a good seaman, or extraordinarily lucky; if he is a good writer besides, he may come up with as crackling good a book as *Family at Sea.*

John Caldwell's first try for Australia – to reunite with his Aussie bride after the war – came to grief on Fiji. We haven't read his first book, *Desperate Voyage,* but it seems to have been good enough to prime the kitty for a successor to his reef-wracked *Pagan,* thus insuring second voyage and second book.

Perhaps a woman aboard brought luck. "Mary was a veteran at the tiller" before they squared away from Pedro for the long one. The luck of *Tropic Seas* was the skill of her master and mate- – skill, and pluck. It is eight thousand miles to Sydney via the Marquesas, Tahiti, Samoa, Fiji. . . . That's a lot of miles for storm and reef to stop a 36-foot ketch in, a lot of miles for illness and accident to strike in. But the Caldwells' story is one of triumph. Several times they nearly had it; but those hours or even days of hanging on with little more than hope were accepted as part of the do-it-yourself kit, and of course were prime ingredients for the book.

In case anyone is thinking at this point that such adventures are fine for young couples unhampered by kids – the Caldwell crew consisted of Johnnie, age five, and Stevie, age one. There was also a stowaway aboard when the *Tropic Seas* sailed from California, who was signed on before the mast in Tahiti, as Roger, age zero.

If getting there is too easy it takes off some of the romance of far away places. We strongly recommend, therefore, that the armchair traveler to Australia in print sail on the *Tropic Seas* and get the feel of ocean distance, of trade winds, and islands, and – tropic seas.

Not to Mention the Kangaroos. By Mulaika Corben. Thomas Y. Crowell Company, New York. 1955. 241 pp: $3.00.

Our special Australia issue is mainly about nature down under. Since an American visitor, even though his only concern be the kangaroo and kookaburra, must enter by one of several populous port cities on the east or south coast, some prior study of Aussie human nature will be found useful.

It must be granted that the American bride of Bert Corben, Australian physicist, saw Australia and its inhabitants through a dark glass of bias – as if not only her husband's family but all other Aussies were in-laws. And even though Mrs. Corben has dedicated her book "to the dinkum [i.e., swell guys] Aussies," it must have caused some wincing in Brisbane, Sydney, Melbourne, and points west. She has pulled no punches on many items of basic difference where it matters –in education, for one – and spared no jibes at lesser things that are just annoying or funny – changing trains at every state border, for instance, because "the seven different states of Australia, showing the independence of puppies suddenly released from the leash, have arbitrarily and autonomously chosen their own particular railroad gauge" (suppose they had 48 states!).

The impression an American reader gets (and the revviewer cannot say from experience whether it is a generally true one) is that by and large Australia is, materially, about

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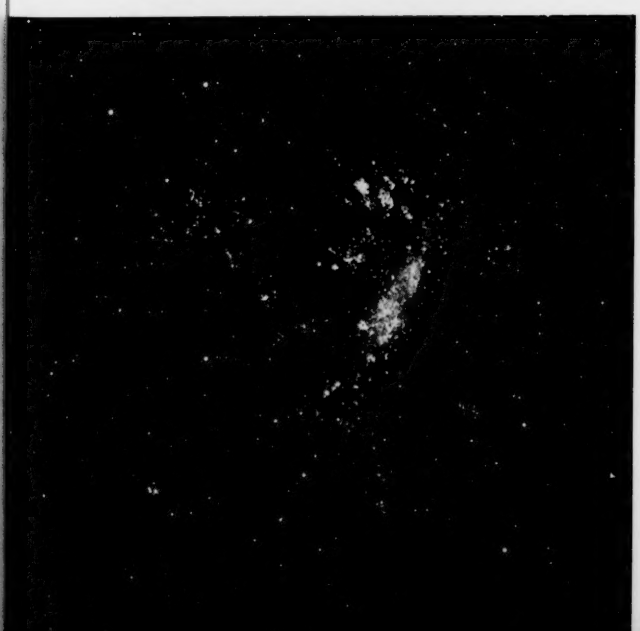
found throughout the Milky Way, and the Coal Sack is one of the most prominent.

These dark regions were once thought to be tunnels through the clouds of stars forming the Milky Way. Today they are recognized as clouds of obscuring material which can best be described as dust. The Coal Sack is a cloud of unbelievable dimensions, enveloping and blacking out the stars in that direction. Photographs of that region show that the cloud has sharply defined edges, and the only stars which can be seen in that direction are the ones which are between us and the cloud. Modern theory proposes that such clouds are the birthplaces of the stars.



Large Magellanic Cloud, July 13, 1953.
(G. De Vaucouleurs, Mt. Stromolo Observatory, Canberra, Australia)

Alpha Centauri, one of the pointer stars which helps to identify the Southern Cross, is of special interest because it is the nearest of all the stars, with the exception of a very faint neighbor known as *Proxima Centauri* which is very slightly closer. Alpha Centauri is a double star. One of the stars is almost a perfect twin of the sun, only very slightly larger and cooler than our sun. The other star of the pair is orange in color, about the same size as its companion, but only about one-fourth as bright. The distance of this pair from the earth is such that light requires 4.33 years to reach us, a distance of 26,000,000,000,000 miles (twenty-six trillion). The two stars move about one another in a period of just under 79 years. They are separated by a distance of about 1,800,000,000 miles, or a little greater than the distance from the sun to the planet Saturn. This is but one detail of the remarkable and relatively unexplored regions of the sky south of the Equator.

The people down under love their sky, too. They proudly point out the figure of the Southern Cross and the hazy patches of the Magellanic Clouds. The Southern Cross has become a symbol of the Southern Hemisphere. It appears on the flags of several of the South American countries, Australia, and New Zealand. The nearest we of the northern worlds can come to a figure of such importance is the Big Dipper. And a vanishingly small percentage of our population can point it out to a visitor from the other half of the world. Could you? G.W.B.

where the U. S. was a half century ago – always excepting, of course, the tremendous and vital development of air transport into and within the interior. (Mrs. Corben seems to be talking about the period just before World War II, and perhaps there have been some changes, certainly so in heavy industry if not in the availability of consumer goods and services.) Nevertheless, what stays is a humorous, and really good-humored view of our own cousins one-ocean removed – cultural and blood (not bloody) kinfolk who are paradoxically more British than the English and at the same time like Americans only more so. Especially, like Americans of our pioneer West.

Edge of the Coral Sea

Nature has dealt Australia a number of unique or just superlative things worth going half way around the world to see – not the least of them, the Great Barrier Reef. "Few Australian subjects have been more written about," C. F. Laseron says, in apology for his one chapter on it in The Face of Australia, *"and a bibliography of works, both scientific and popular, would itself fill a volume." Among others, he mentions C. M. Yonge's* A Year on the Great Barrier Reef, *and T. C. Roughley's* Wonders of the Great Barrier Reef. *Since our Australia issue does not include an article on it, these books should be noted here for their presentation of earth's greatest concentration of living coral and associated reef life: Dr. Yonge, the noted British marine biologist, writes of the Reef expedition he led in 1928-29; Professor Roughley's book is a perennial classic. Now comes one which is to be read for the adventure of underwater exploration in a supreme setting – the author, an Englishman best known for his contributions in the field of future exploration in space:*

The Coast of Coral. By Arthur C. Clarke. With photographs in color and black-and-white by Mike Wilson and Arthur Clarke. Harper & Brothers, New York. 1956. x + 208 pp., 13 full-color photos, 46 half-tones, chart. $5.00.

Readers of *The Exploration of Space* know Arthur C. Clarke as a writer fully equipped with scientific training; those who know him through his science-fiction novels (such as *Prelude to Space* and *Earthlight*) admire his powerful narrative faculty. It may surprise some to find him at home under Earth's ocean, familiar with fishes and mollusks; but his ability to write both entertainingly and informingly of his personal adventures in this non-ethereal medium will surprise none who know him in his more familiar one.

Getting to Australia is simple (unless you do it the Caldwell way) but progressing from your port-of-entry to some point, say, up the coast, may be infinitely complicated by the exigencies of surface travel. Mr. Clarke and his companion Mike Wilson found this out after making the simple decision to buy a car and drive themselves and gear – aqualungs, cameras, etc. – from Sydney to Brisbane to the reef-port of Gladstone, Queensland. But flood, mud, and accident could not keep them from the romantic Reef. The prelude is further livened by some shakedown diving and sundry extracurricular misadventures; the main show eventually begins with their landing on tiny Heron Island, in the Capricorn Group, astride the tropic. For six weeks the only world is a pinpoint of land pulsating between high and low tides which now give, now take, in ceaseless rhythm, a broad esplanade of walkable wonder, the bivalent tidepool world of crabs and coral heads, of nudibranch, starfish, and sea urchin – this and, sometimes miles out, the true underwater world of the fringing reef.

What Clarke has written about his personal invasion of this newly conquerable world may lack the heroics of Hass, the dedicated professionality of Cousteau, and the virtual mysticism of Diolé. Yet it has a liveliness, a freshness of discovery, and a motivation of sheer curiosity plus love of physical adventure that assure it – under Clarke's skilled hand – of a proper place in the fast-growing literature of skin-diving.

There is also the trip to Torres Strait and Thursday Island, where Mike taught the native pearlers some new tricks; life aboard a lugger; and – returning to the Reef – a sample of tragic human history in the epic story of Mary Watson. . . .

A final chapter evaluates. "In an age which is seeking new frontiers, the Great Barrier Reef provides one of the few unexploited – indeed, largely unexplored – regions still remaining on this planet. In at least three major fields of human activity – commerce, science, and recreation – it offers opportunities which it would be hard to match elsewhere. . . . The waters of the Reef yield fish and shell to the value of over a million pounds a year, and this output could certainly be much increased. . . . To the scientist – whether his interest lies in geology, biology, oceanography, or even anthropology – the Great Barrier Reef presents a challenge which, largely because of the difficulty of transport over such distances, has not yet been properly met. . . . In the foreseeable future, the Reef could become one of the great playgrounds of the world. This is not a prospect that I view with unmixed pleasure, though I hope and believe that the Reef is too big to be spoiled by man. . . ." And of a day when nature took complete charge: "The storm was destroying billions of the coral animals, shattering their tiny homes around them. But even before it had passed and the seas were calm again, the mindless architects who built this twelve-hundred-mile-long range of sunken mountains would be at work repairing the damage. They laid the foundations of the Reef ages before man appeared upon this planet; and theirs is a monument which may still endure when all the creations of his brain and hand have passed away."

Walkabout men

A great deal is being written these days about the Australian aborogine, his vanishing way of life; his future, if any; his art. Books previously reviewed here: Adam in Ochre, *by Colin Simpson;* Brown Men and Red Sand, *by Charles P. Mountford.*

The First Australians. By Ronald M. Berndt and Catherine H. Berndt. Philosophical Library, New York. 1954. 144 pp., 27 photographs, numerous line drawings. $4.75.

Two Australian anthropologists, husband and wife, have written this small book for the purpose of introducing to other white Australians their dark-skinned countrymen, the Aborigines (they use the capital throughout), and giving an outline picture of their way of life. If there is one thing these authors apparently want to make clear above all, it is that the Aboriginal way of life is indeed a "different way" from that of the European, "involving different criteria and values. It had simply developed along different lines from ours – different in kind, not in quality nor in degree. Moreover, it was, and is, contemporary: not an ancient survival, arrested in development, nor radically confined through mental retardation."

The Aboriginal is not a "dawn child" who forgot to grow up. The white invaders of his ancient homeland found him altogether the master of his own environment. It became a truism that the Aboriginal of the Desert Center could find food and water where the European would simply die for want of both. But although possessed of equal human intelligence, he could not possibly alter over-

BOOKS FROM AUSTRALIAN PRESSES

WITHOUT apology we borrow the title of a little pamphlet which comes to us monthly through the courtesy of Angus & Robertson Ltd., a leading Australian publisher of books. Under its cover (from which we have also lifted the kangaroo) we find a wide variety of subjects, from motor manuals to poetry, from sports to philosophy. Naturally there are at least as many titles as one would expect which refer to Australia itself, or some part or aspect of it. In making selections to present here we have, needless to say, sought from the latter group those which we felt would appeal to our American readers looking for further information, inspiration, or pleasure.

"If there is a better book of its kind on Australia, I have yet to see it," one critic has said of Charles Francis Laseron's **The Face of Australia: *The Shaping of a Continent*** (Angus & Robertson, Sydney. 1954 [2nd ed.]. xii + 244 pp., 39 photos, 31 text figs. and maps, endpaper map. 21s). After a fair sampling of the lucid prose in which Mr. Laseron tells the fascinating story behind Australia's rather special landscape, one feels no need of looking for a better book. Mr. Laseron's talent for clothing the bare bones of a continent with lively interest and the calm beauty of natural forces at work through ages of time, is likewise illustrated in his companion volume, **Ancient Australia: *The Story of Its Past Geography and Life*** (A. & R., Sydney. 1954. xiv + 210 pp., 30 halftone plates, 15 text figs. and maps. 25s). This makes a perfect follow-up to Jack T. Woods' "Darling Downs" article, if fossils are your dish. Fitting complement to the text, in both excellent books, are the exceptionally clear and well selected photographs.

Speaking of photographs, the name Frank Hurley appears under one or two in this issue — a name which stands at the top in Australia for portrayal of the national scene. A fine example of Australian printing is at hand in generous format, with **Australia: *A Camera Study*** by Frank Hurley (A. & R., Sydney. 1955 [reprinted 1956]. 208 pp., 47 pp. in full natural color, hundreds of halftone photos. 45s). While Laseron's "face" of Australia is the natural one, Hurley has taken it as it comes, Australians and all. There are many scenes of untrammeled nature, of course — wild coasts, a gorge in the Hamersley Range whose stepped red cliffs are Arizona to the life, a misted tree-fern dell with waterfall which is unsullied Tasmania, the Blue Mountains, coral reefs, caverns. But take Sydney Harbor and its famed bridge, staid Victorian Melbourne, a modern steel mill or vast open-pit mining operation, gleaming Canberra, canefields, apple orchards, vineyards, cathedrals, libraries, universities, homes — these are the impress of a very few millions of extremely energetic people in little more than a night the basic pattern of his existence in the manner or to the degree that would have enabled him to cope with the invader. It is tribute to the strength and validity of his way that he managed stubbornly to survive at all through a time when the European tried hard to exterminate him before making the great economic discovery that his hands were indispensable for the planting of European pastoral culture in Australia's hostile interior — that the "blackfellow," in short, was a born stockman.

It is another truism that change is inevitable. But — and with this our author, Tindale, may disagree — "For these Aborigines," the Berndts say, "contact need not mean death. They are not doomed by some mysterious law to vanish, inevitably, from the white man's world. . . . They cannot continue to live in their old way. . . . It seems certain that they must, in the coming generations, become more fully absorbed into the main stream of Australian life. But they have something to offer us, too — something of their vitality and colour, the spiritual heritage of the Aboriginal Way."

Unesco World Art Series: Vol. III. Australia: *Aboriginal Paintings — Arnhem Land.* Introduction by Sir Herbert Read. Preface by Charles P. Mountford. The New York Graphic Society (by arrangement with Unesco), Greenwich, Conn. 1954. 18 pp. + 32 full-color plates, 13x18¾ inches. $15.00.

Of this series of beautifully produced volumes illustrating some of man's crowning achievements in art through the ages, the first two, *India* and *Egypt*, and the fourth, *Yugoslavia*, have been reviewed. The fifth, *Norway*, will be noted, appropriately, in our coming Christmas Book issue, since it portrays early Christian church architecture. The present volume, *Australia*, has of course been "saved" for this special issue.

Sir Herbert Read, in what is properly the preface, explains briefly why these recently discovered aboriginal drawings on rock and bark in the extreme north of Australia deserve the name of art. Two chief and simple reasons are that they are "composed" and that they have "sensuous quality." They have, moreover, a "most potent characteristic"—*magic*. "The original magic of these paintings is forever closed to us: what is magically significant for the aborigine is merely mumbo-jumbo to the European aesthete. Nevertheless, these paintings, by virtue of the images they project, have an archetypal significance for people of all races."

Thus one anthropologist; and another, Charles P. Mountford, in what should be termed introduction, gives the briefest possible précis of Australian aboriginal art as context for a more extensive examination of what is here presented, from Arnhem Land. The cave paintings, mostly, "belong to an age not yet defined," while "few of the bark paintings . . . could be more than a year old when collected." Whether continuous with its own past or not, this was found as an art tradition and practice *in being*, and belonging, through its adherence to "principles of line, colour, balance, and spacing of design elements which are present in all great art," to the larger continuum of world art from Altamira and Dordogne to whatever is to survive from the present.

Our cover is but a thin shadowing of one of the richly rendered plates (XXXI) of this book. D.G.K.

century on a land as big as ours. Frank Hurley has portrayed Australians as much as Australia, and done both with mastery of lens and film. And the printer has not let him down. There are descriptive captions, and a page or so of text about each state to mark the divisions of the book.

What Frank Hurley has done with camera others have done equally well with pen – giving the feel and flavor of the country. Alan Moorehead's *Rum Jungle* (previously reviewed) is a case in point. Our reading has discovered such as Arthur Groom, whose – sad to say, posthumous – **Wealth in the Wilderness** (A. & R., Sydney. 1955. 198 pp., 45 photos, endpaper map. 21s.) is a compelling narrative of the author's motor trip through a Center and North West ravaged by recent drought. His constant theme is that men and women do live and produce here, no matter what – such is the breed: tough, resilient, resourceful. What holds them, it may be – one thing, at least – is this picture of a good year: "There is no grander sight in Australia than a vast plain strongly grassed in spring, spreading to every horizon with a running wind scudding it in waves. There is moving magic in the hour before sunset and the morning hour after sunrise, with gleam of dew on grass, horses and cattle belly-deep in it, sheep almost buried in it." Next year is sure to be better . . . and sometimes it is.

There is a time in a land when it is new and pioneers are young with it, and grow with it, reveling in youth and boundless horizons and limitless futures. This was Ion L. Idriess and in **Men of the Jungle** (A. & R., Sydney. 1955 [reprinted]. 220 pp., 13 photos. 18s.) he has given a rare gift for story-telling to that time in his life when with two partners he hunted gold in the York Peninsula between Cooktown and Cairns. In form this is almost a novel: there was a lovely thing named Mee-lele, of the mixed coastal community – Chinese, Malay, and what-all – "whose romance runs like a gold thread in and out through the whole book"; and assorted characters such as one expects to find on the fringes of the world. Born raconteur he is, but Idriess is just as apt at descriptions of nature, in the way of a man who has lived with it, lovingly, quite content to belong there.

There is another side to the Great Barrier Reef, the side of human history which contains the epic passages of Cook and Bligh; a ghostly procession of wrecks and castaways, a grim legion of cannibals, slave runners, pirates, and other entrepreneurs of violent death; "hermits on coral isles"; and the valiant beyond ordinary reckoning – such as Mary Watson, whose story Frank Reid has likewise told (see review, *The Coast of Coral,* above) in **The Romance of the Great Barrier Reef** (A. & R., Sydney. 1954. xii + 191 pp., chart, chapter-head cuts. 22s. 6d.). This collection of true, if frequently all but incredible, tales of man against sea and man, has been garnered from every source, from oldest inhabitant to archival document and newspaper file, and is vouched for in Foreword by a "Late Honorary Secretary, Queensland Royal Geographical Society," on Thursday Island.

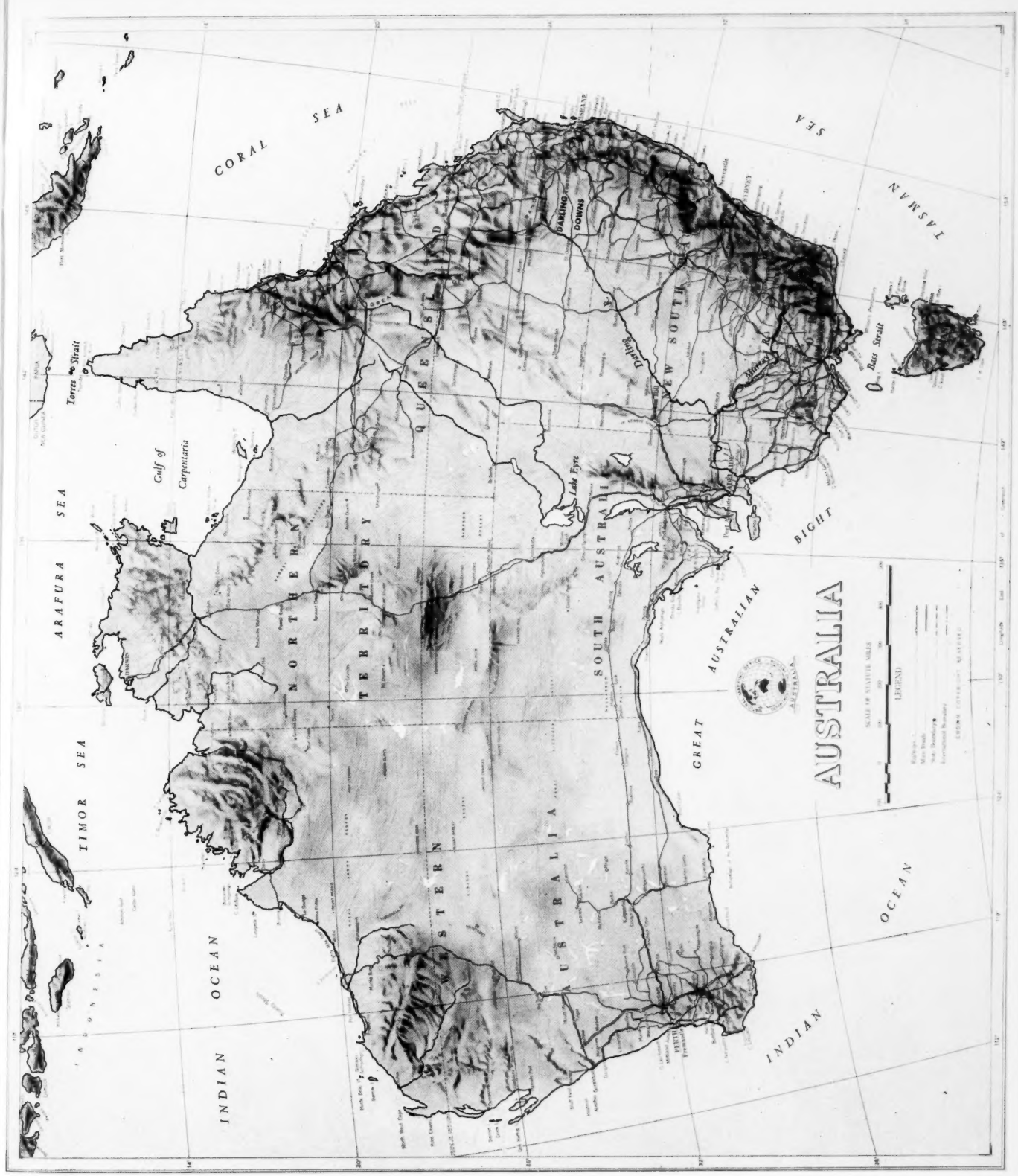
Those who have discovered in Colin Simpson's *Adam in Ochre* a top-flight reporter on Australia's aborigines and anthropological work among them, will be glad to know of new titles in the "Adam" series: **Adam with Arrows: *Inside Aboriginal New Guinea*** (also A. & R., but the edition at hand is the American: Praeger, New York. 1955. 240 pp., profusely illustrated with full-color and halftone photos, maps, line cuts. $5.00); **Adam in Plumes** (A. & R., Sydney. 1954 [2nd ed. 1955]. xvii + 268 pp., 12 pp. full-color plates, 16 pp. halftones, also line cuts, maps. 25s); and **Islands of Men** (A. & R., Sydney. 1955. 248 pp., 12 full-color plates, 26 halftones, also line cuts, maps. 25s.). Simpson deserves much kudos for reporting to Australia and the world on some of the least known of Earth's peoples – some of them not known to exist only 23 years ago – and on the work of the Commonwealth Government men whose mountainous job it is to bring them to the "Pax Britannica" and the threshold of modern civilization. Consider that inside New Guinea and some Melanesian islands these included – may still include – head-hunters living in the Late Stone Age, to whom the white man was, at first sight, a totally new order of being. An ethico-moral problem arises at once. But since it appears to be congenitally impossible for the European-stock man to leave his "backward" brother to live out his life undisturbed on his share of the common inheritance, Earth – then probably it is best that the sophisticate bring the country boy up to date on developments as painlessly as possible and orient him into the metropolitan human family. (This is not editorializing here, only remarking what's going on.) In that case, then it would appear certain to the outsider, from Mr. Simpson's scrupulous reporting, that official Australia is doing the right thing by its Papuan and Melanesian charges. Anyhow, the story is exciting and enormously interesting.

Adam in Plumes might be singled out for added mention (although each book has its own special character and intrinsic interest). It tells the story of the discovery in 1933 of a mountain-walled valley high in New Guinea's heart, where the white world firmly believed only uninhabitable mountains existed. But the astounding revelation was that this – along with other mountain fastnesses of the hitherto unexplored central region of the world's biggest island – contained *"half a million people who weren't supposed to exist!"* (Colin Simpson, italics ours). Furthermore, these people of the Wahgi Valley, as it was named, who "had no conception of the sea or of any world beyond their mountains," who made fire by means of a bamboo thong and made axes of stone, "yet had a pride and artistry of personal ornamentation and land beautification, and a sense of ceremonial pageantry, that distinguished them from all the known peoples of New Guinea and which – still retained . . . makes them today the most picturesque primitives left on the face of the earth."

Australian history is short, as modern nations go, but made of robust material. To know it in some degree is to better understand Australia's place in the Pacific and in the world community – an increasingly important place. The titles mentioned are directed to this understanding: **Australia: *A Social and Political History,*** edited by Gordon Greenwood (Frederick A. Praeger, New York. 1955. xiii + 445 pp., frontis. $7.50), a symposium of Australian historians; **Australia** by J. C. Horsfall (Frederick A. Praeger [Nations of the Modern World Series], New York. 1955. 216 pp., inset map. $4.95), vigorously written, is chiefly concerned with the great period of development since Pearl Harbor, while summarizing what went before.

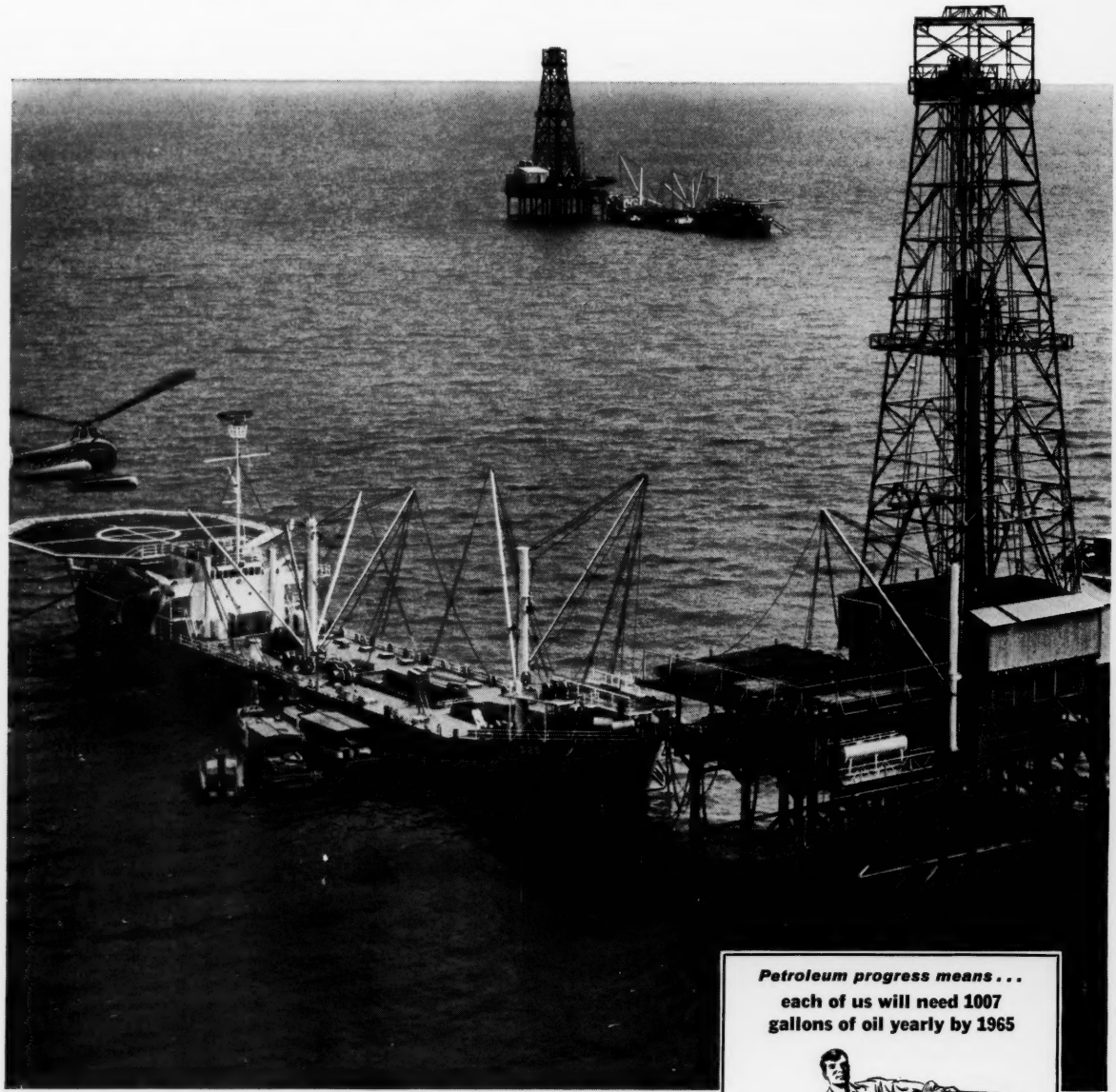
This came after the present issue was on the press: **Southwest Pacific: *A Geography of Australia, New Zealand, and Their Pacific Island Neighborhoods*** by Kenneth B. Cumberland (Whitcombe & Tombs Ltd., Melbourne, Wellington, etc. 1954 [reprinted 1955]. xviii + 365 pp., 93 text maps, 99 halftone plates). Designed to teach New Zealanders something about Australia, Australians something about New Zealand, both something about their Pacific context, and the rest of us something about all three, this book is going to prove – we can tell at a glance – a very valuable source-book at the editorial elbow. Time does not permit us to report on it now as it deserves.

Note: We have not attempted to run down U. S. prices for the Australian editions reported on here; these can be readily had from your bookseller, and we believe will be surprisingly low. Your dealer can order them. D.G.K.



AUSTRALIA IN RELIEF. Original in color with light blue shoreline, drainage, and hydrographic names; we have superimposed shoreline, main rivers, and some names in black. Reduced. (Crown Copyright Reserved; reproduced by permission of National Mapping Office, Department of the Interior, Canberra)

25 cents of every dollar Standard takes in goes to meet your future oil needs



Our search for oil has carried us to the sea, even though drilling offshore wells like this one (in the Gulf of Mexico) costs nearly 6 times more than land wells.

BUILDING "ISLANDS" IN THE SEA from which to probe the ocean floor is one good example of how we must search farther afield to find the oil America uses in such quantity. And as new sources of oil become harder to find, locating it and bringing petroleum products to you grows more costly.

Last year, a quarter of every dollar Standard took in was plowed back into oil exploration, development of producing fields, research and construction of facilities. All told, during 1955 we invested $347 million to help meet your growing oil needs.

Petroleum progress means . . .

each of us will need 1007 gallons of oil yearly by 1965

1956
817 gallons per capita

1965
1007 gallons per capita

STANDARD OIL COMPANY OF CALIFORNIA

puts petroleum progress to work for you